SCIENCE

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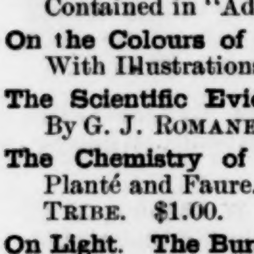

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SCIENCE

FRIDAY, APRIL 17, 1896.

CONTENTS:

MSS. intended for publication and books etc., intended for review should be sent to the responsible editor, Prof. J. McKeen Cattell, Garrison-on-Hudson, N. Y.

MUSEUM METHODS.

THE EXHIBITION OF FOSSIL VERTEBRATES.

THE exhibition of fossil vertebrates is a subject that may be treated from various points of view, but the purpose of the present paper is to deal with it from the standpoint of a vertebrate zoölogist, and to discuss the question what should be the relationship between the sections of a museum devoted to the exhibition of living and extinct animals. That there is, or should be, a very obvious connection between these two sections of a great museum is undeniable, although the relationship is generally ignored and, as Prof. Flower wrote in regard to the collections of the Royal College of Surgeons: "The specimens continued to be divided primarily, not according to their zoölogical or anatomical relations, but by a most inconvenient and artificial system, according as the animals from which they were derived lived before or after a particular period of the world's history."

While the *complete* divorce of recent and extinct animals is unfortunate, Prof. Flower's plan, on the other hand, goes to the opposite extreme, and while it may be applicable to such a collection as that of the Royal College of Surgeons, it does not seem applicable to the exhibition series of a large museum.

The question really at stake is, shall extinct animals be treated from a zoölogical or a geological standpoint; is it more important to exhibit the relationship of animals to one another as if they lived at the same time, or to show the forms of life which existed at a given geological epoch, and the various steps by which the existing order of things has been reached. No museum is large enough and rich enough to do both these things on an extensive scale, and the decision is practically unanimous that it is the province of paleontology to show the faunas of the past as it is that of zoölogy to show the fauna of the present. A purely zoölogical arrangement of all animals in a museum, recent and extinct, would probably fail of its own weight and extent. Prof. Flower himself recognizes the fact that there are difficulties in the way of a strictly zoölogical arrangement, for in the 'Guide to the British Museum of Natural History' he says: "Notwithstanding the objections which may be urged against this primary division of living things, it is one which prevails largely in museums, and which, owing to certain conveniences, as well as to the difficulty and expense of rearranging extensive collections and reorganizing the staff in charge of them, will probably be retained for some time to come."

Arranged geologically fossils tell the condition of life at any given stage, and show how fauna after fauna has arisen and passed away before that of the present was reached.

It might be thought that a collection could be arranged phylogenetically, but this is a physical impossibility, for, even were space available, specimens could not be so arrannged as to act as a genealogical tree and show at once their common ancestry, lines of descent and relations to one another. To do this is the province of a diagram or diagrams, and there is usually some wall space well fitted for this very purpose that is otherwise unavailable or could not be used to better advantage. Morever, the lines of descent of the majority of vertebrates are wholly or partly hypothetical, and this is a serious drawback to arranging a museum on a phylogenetic plan. Series to illustrate the line of descent of a group or species whose phylogeny is known are, however, invaluable and most instructive, and the museum which is fortunate enough to possess the necessary material cannot do bettet than to provide them. Just such a series is that illustrating the phylogeny of the horse, on exhibition at the American Museum of Natural History, in New York city.

The relations of extinct to existing animals are to be shown in two ways, or in two departments of a museum: firstly, in a synoptic, or index series; and secondly, in a general systematic system of skeletons. The synoptic series may be compared to a general introductory work on zoölogy, prepared with special reference to the needs of the public and those commencing the study of zoölogy. A systematic series is a detailed, descriptive catalogue, whose object is to furnish information for the advanced student. The idea of the synoptic series is yet in the earlier stages of development, and it seems not improbable that this will eventually come to occupy a large space in a biological museum. In the systematic osteological series the province of fossils is to round out the collection, to bridge over gaps between apparently unrelated forms and supply the missing steps which time has removed from the phylogenetic stairway. A most striking example of the need of intro-

ducing extinct forms in a collection is shown by the great gap now existing between birds and reptiles, a gap which the Dinosaurs and Archæopteryx will bridge over and by their presence make clear the affinities of these two great classes. Now a mere placing of fossils in their proper places will not do this, for the average fossil, crushed, mutilated, distorted, means very little to the average visitor. To do the thing properly we should have a complete and, preferably, a full-sized restoration of the extinct species, but this, the ideal method, is for many reasons far in the future; the *complete* structure of the majority of forms is unknown, while the cost of the knowledge and skill necessary for making such restorations puts a prohibitory tariff on their manufacture. Meanwhile the best that can be done is to supply their places with good figures,* but when this is done the drawings should be supplemented by specimens of casts of fossils to show the material on which the restorations are based and, which is almost as important, to give an idea of the size of the creature figured. Moreover, these specimens are needed as a guarantee to a somewhat suspicious public that the animals did actually exist. With the aid of these models, figures and specimens, supplemented by, or supplementary to, good labels, the relations of existing forms may be made plain and the exhibition series symmetrical.

A paleontological series then should be complementary to that of recent animals; the bulk of it should be by itself and arranged geologically, but, as fast as opportunity offers, the gaps between existing groups should be filled, so that, aided by the labels, the visitor may see that the relation between existing forms depends in many cases on species long ago blotted out of existence.

* Just how to introduce these drawings in the exhibition series is a problem which I have incubated for two years or more without hatching a good solution.

Such a series should not be too large, for its object is to show clearly the principal modifications of vertebrate structure, and the display of too many forms tends only to confuse the visitor, or general student, for whom such a series is intended. It may, perhaps, be an open question as to just what 'too large' means. In my own case it means that I would not go beyond the representation of families, although where there is much diversity of form within a family more than one species may be introduced to advantage. And when all families, living and extinct, have been properly represented, the series will be of no mean proportions.

FREDERIC A. LUCAS.

WASHINGTON, D. C.

This paper was written some time before the appearance of Sir Henry Howorth's article on Paleontological Museums in the February number of *Natural Science*, and his ideas as to the value of certain material lead me to add as a postscript some sentences striken out of the rough draft of my own article.

The questions arise as to whether it is worth while to exhibit many of the vertebrate fossils seen in museums and if they do not occupy space which might be used to better advantage. Much of the material shown, single teeth, fragments of bones, odd vertebræ and broken skulls, while, valuable enough to the paleontologist, are as caviare to the public. Even to the average student they are of little value unless he can handle them, and, while a certain amount of material is needed to impress upon the public the number and variety of the animals which have passed away, all beyond that simply tends to confuse rather than to instruct. And personally I am of the opinion that many of the objects ordinarily seen on exhibition might advantageously be relegated to the study series.

F. A. L.

MUSEUM METHODS.

ON THE ARRANGEMENT OF GREAT PALEONTOLOGICAL COLLECTIONS.

A MUSEUM is defined by Dr. Goode as "an institution for the preservation of those objects which best illustrate the phenomena of nature and the works of man, and utilization of these for the increase of knowledge and for the culture and enlightenment of the people." *

The fundamental principles or aims of a museum having been defined, it is necessary to consider next in what manner collections of fossils may be arranged to fulfill these objects. The primary purposes are manifestly two: namely, to interest and instruct the *general public*, and to facilitate the researches of the *student of extinct life*. The latter class of museum visitors is composed of two kinds: namely, faunal geologists, or students of historical geology, and paleobiologists, or students of general biological phenomena.

"It is necessary to bear in mind," writes Sir Henry Howorth, "that it is a mistake to deal with mineralogy and paleontology as if they were sub-sections of geology," since "the great bulk of paleontological remains do not appertain to geology at all, but to the special provinces of zoölogy and botany."† This principle has long been accepted in the U. S. National Museum, and for many years the paleontological collections have been completely severed from the geological collections. In the Department of Geology there is, however, a small collection of fossils with samples of the rocks in which they are found, in order that the student of geology may learn to know readily the characteristic fossils of each system and the time of introduction of all the leading types of animals and plants. This collection is at present made up of American fossils, but it is intended to obtain from every province all specimens necessary to illustrate the second object of this, the '*Historical Collection*.'

*The Relationship and Responsibilities of Museums, by G. Brown Goode. (SCIENCE, Vol. II, new ser., p. 198, Aug., 1895.)

†Some Casual Thoughts on Museums, by Sir Henry Howorth. (Natural Science, Vol. VII., p. 322, Nov., 1895.)

THE GENERAL PUBLIC.

This is the largest class of museum visitors, but the one least interested directly, so it need be shown only a series of specimens properly prepared for exhibition. "A museum is rarely justified in exhibiting all its materials. An exhibition series, when properly installed, is more effective when limited than when extensive." * To interest the public the exhibition series should be mounted in an attractive manner and made intelligible by descriptive labels. Only good and well-cleaned fossils, yet not too many species, should be shown, since otherwise a rapid survey of the specimens grouped around the descriptive labels is not attainable. Drawings or prints should, when possible, accompany small fossils, and occasionally a crushed specimen may be made comprehensible by introducing a restoration or the shells of living, but closely related forms.

STUDENTS.

On the other hand, students and original investigators must have consideration of a quite different kind. Since this small but critical class of museum visitors has objects distinct from those of the general public, it will be necessary to arrange collections so as to satisfy the needs of both. The general public should be interested and instructed, while the student requires an orderly arrangement of material to facilitate ready reference.

An exhibition series is primarily intended

* Recent advance in Museum Method, by G. Brown Goode. (Smithsonian Report. U. S. National Museum, p. 57, 1893.)

for the general public and the student, and consequently should be divided into *stratigraphic* and *synoptic collections*. The investigator may advantageously make use of both of these series, but will have additional aid in the *study collections* and the *card catalogues*.

In recent years there has been a decided tendency to group all fossils according to their biological rank. This is proper if the chief object of a museum is to teach paleobotany and paleozoölogy. In large museums, however, it is necessary to teach not only everything pertaining to morphology, but the sequence of faunas, or historical geology, as well. Plants and animals do not occur in nature grouped according to their biological rank, but are associated because of their environment and geological history. If the great bulk of fossils is arranged biologically then the grouping and interactions of the individuals of a province or zone are apt to be lost sight of. Paleontologists seeking for the relationship which the various provinces bear to another, or the presence or absence of barriers against the dispersal of floras and faunas, will be seriously embarrassed by any arrangement other than stratigraphic. The dual evolution of the horse, or of the Terebratellidæ among the Brachiopoda, are problems both of the faunal geologist and of the systematic zoölogist as well.

A stratigraphic exhibition collection aims to show only the essential animals and plants of various well-marked geological horizons, and these systematically arranged, both geologically and biologically. It should be sufficiently extensive to illustrate clearly Historical Geology, or the order of distribution of fossil remains throughout geologic time.

It is seemingly neither proper nor advisable to note all the minor geological horizons in large stratigraphic collections like those of the National Museum. For a clear demonstration of the facts of faunal geology, it is sufficient to group all the organisms of the Cambrian system into three divisions, representing the Lower, Middle and Upper Cambrian, respectively. The Ordovician system, in like manner, should be separated into Calciferous-Chazy, Trenton and Cincinnati groups. The labels accompanying the species should indicate the minor, or local, geological horizon. Practice has also shown the advantage of grouping together all the fossils of each basin or geological province, since in this way only is it possible to indicate clearly the relations which the various provinces bear to one another. Such an arrangement will necessarily cause duplication of certain species, but this is not objectionable, as the forms recurring in two or more provinces illustrate to what extent geographic dispersion has taken place. This method of installation was introduced in the Cretaceous collection of the U. S. National Museum some years ago, by Dr. C. A. White, and has proven practically useful to working paleontologists. It is also in harmony with Sir Henry Howorth's idea that "there should be no attempt made to fill up gaps in one area by inserting evidence from another." *

A stratigraphic collection will also show the introduction in time of the various types of organic beings, and the gradual rise from the ancient and less complex floras and faunas to those of greater complexity characteristic of the more recent geological epochs.

In large museums it is advisable to have distinct and separate paleobotanical, invertebrate and vertebrate collections. Fossil plants and vertebrates are often so large and bulky as to require a method of installation quite different from invertebrate fossils. In small or local museums the various animals of a zone should be kept together,

* (Ibidem, p. 323.)

since it is their province to illustrate the detail of their natural surroundings.

A *Synoptic Collection* should show the anatomy, embryology, terminology and evolution of every class, together with all the generic steps through which each family has gone in past ages. The first two divisions of the synoptic collection may be illustrated by models and drawings, the terminology by specimens and drawings, colored after the plan so successfully initiated by Bather for the crinoids and Lucas for the vertebrate skull. The genera should be illustrated by typical material of the species on which the genus is based, either by specimens or by figures, or by both, while the labels should give fully the geologic and geographic distribution.

To install the material illustrating the anatomy, embryology and terminology of a class is not difficult, but it is somewhat hard to determine how the generic material shall be shown so as to illustrate the devious paths through which a given class has passed —in order to set forth the course of its evolution. This may be accomplished by grouping the generic tablets of each family in one or more vertical columns. At the base of each is the label giving the name and a short definition of the family characters. The families should be grouped into superfamilies, orders, superorders, and the characters upon which these divisions are based should be clearly set forth on the accompanying descriptive labels. A definition of the class and the known phylogeny should also be displayed in each exhibition case. Plants and vertebrates in the synoptic series, because of their generally large size, must for the most part be illustrated by mounted pictures.

A recent species of all genera having fossil representation should be introduced into these collections, and on each tablet should be given the present specific representation and geographic distribution of the genus.

In the synoptic collections, more than anywhere else, is the need of technical terms necessary for a clear definition of the various divisions illustrated. It is for this reason that each class of organisms in this exhibition series should be accompanied by specimens or drawings colored to attract attention to the part to which the term is applied.

The synoptic collections need not be limited to the illustration of the generic evolution of the classes, but may be advantageously extended to illustrate the evolution of certain specially interesting families, genera, or even species. What series could be more interesting than one illustrating the evolution of the horse or one showing the enormous time dispersal of Lingula and Crania or Pleurotomaria or of Leptœna rhomboidalis and Atrypa reticularis?

The *Study Series* is not, as a rule, on exhibition, but is stored unmounted in drawers arranged in paper trays. This is the great reserve collection of a museum, and from it the curator derives material for the exhibition series, while the paleontologist or biologist depends upon it for purposes of study. This collection contains no duplicate material for distribution or exchange and must be kept intact. The study collections, since they have no uses other than those just mentioned, should therefore be arranged stratigraphically, this seemingly being the only available method for the administration of so vast an assemblage of fossils. The specimens of each class should, of course, be kept together within each geological group, and this is true also of the floras and faunas of each province. The above treatment of the study collection does not perhaps accord with a strictly biological view, but the needs of the biologist can be provided for by complete card catalogues of all the fossils in the museum.

The *Catalogue* is the most important agency in the possession of the curator,

and its management is the highest test of his capabilities. Every species from a single locality, in whatever permanent collection it may be, should be registered upon a separate card giving name, systematic position, terrane, locality, number of specimens, source whence obtained, place of disposition in museum, museum register number, and, if a type published or even a specimen especially referred to in a publication, an exact reference should be given to page and plate. Such cards should be arranged alphabetically, and without regard to any other classification. By the aid of this catalogue, the curator is in the position to know just what material the museum has in stock, and can respond promptly to requests for the loan of material, since the place of any specimen can be ascertained at once. The bulk of the fossil collections being arranged stratigraphically, faunal geologists and paleontologists will be able to secure promptly any desired information without the necessity of referring to the catalogues, while other students of extinct life can refer to any or all the species of a group in the museum by the aid of the catalogues. The cards of this catalogue in use in the U. S. Museum are $4\frac{1}{2}$x$6\frac{3}{4}$ inches.

Additional aid can be given the systematic biologist by providing a generic catalogue grouped into classes. Only those genera of which there is material in the museum will have representation in this catalogue. On these cards may also be given the type species and its locality and the place of original description.

The *Duplicate collection* exists for exchange purposes only, is constantly changing, and requires no attention except in the matter of preservation of identifications.

In *Recording the specimens* in the U. S. National Museum, each lot of fossils is given a general accession number as soon as received, and later, when the material has been studied, each species from a single locality is given a permanent '*museum register number*.' The latter, when practicable, is written upon each specimen, and opposite this number in the record book is entered the name, locality, date and any remarks pertinent to its history. To fossils brought together by the U. S. Geological Survey are attached small, round, green or yellow tickets, upon which are written numbers referring to the '*locality book*.' This method is preliminary to permanent record. Either system permits the assembling in one tray for study, all the material of a species from many localities, without danger of confusing their history. "Specimens can be named at any time, but the locality once lost, the object becomes comparatively valueless. The record of donors should be accurate and complete so that the specimens from any given source can be traced at once to their location." *

Types and illustrated specimens should have in addition to the museum register number, some conspicuous mark to call attention to their great scientific value, and to guard against loss. In the U. S. National Museum a small, green, diamond-shaped ticket is pasted on each specimen; this being a method long in use by Prof. James Hall. CHARLES SCHUCHERT.

U. S. NATIONAL MUSEUM,
WASHINGTON, D. C.

THE FLOW OF THE CONNECTICUT RIVER.†

THERE is a general and doubtless well-founded belief that the cutting of the forests is injurious to the flow of the streams whose basins are thus denuded. This belief is based upon the common experience of men long familiar with the streams in question, and is also supported by theory. Few opportunities, however, exist for definitely measuring the effect that is produced, for the reason that upon very few streams have

* Goode. (loc. cit., p. 58.)

† Read before the American Forestry Association, 1895.

reliable and long-continued observations of discharge been made. Your Association meets this year upon the banks of the Connecticut river, upon whose upper drainage area the clearing away of the forests has been for many years, and still is, progressing. At two points upon this river, Hartford and Holyoke, an unusual number of continuous observations of flow have been made, and it has seemed to me desirable to examine them and see whether they reveal any changes in the character of the flow which could be ascribed to the cutting of the forests.

At Hartford the tributary area is about 10,200 square miles, and for a period of over fifty years records are available of the maximum freshet height of each year. Further, observations to determine the daily rate of discharge were begun in 1871 by General Theodore G. Ellis, and were continued without interruption until 1886, although for 1882 and 1883 the figures are not at hand. There was thus obtained a record having few parallels in this country, and it is deeply to be regretted that the United States engineers should have permitted it to be discontinued, as was done in 1886. At Holyoke, where the drainage area is about 8,000 square miles, the Holyoke Water Power Company has maintained since 1880 a daily record of the discharge of the river past that point, which record is still continued and is on the whole the most valuable that now exists regarding the discharge of this stream.

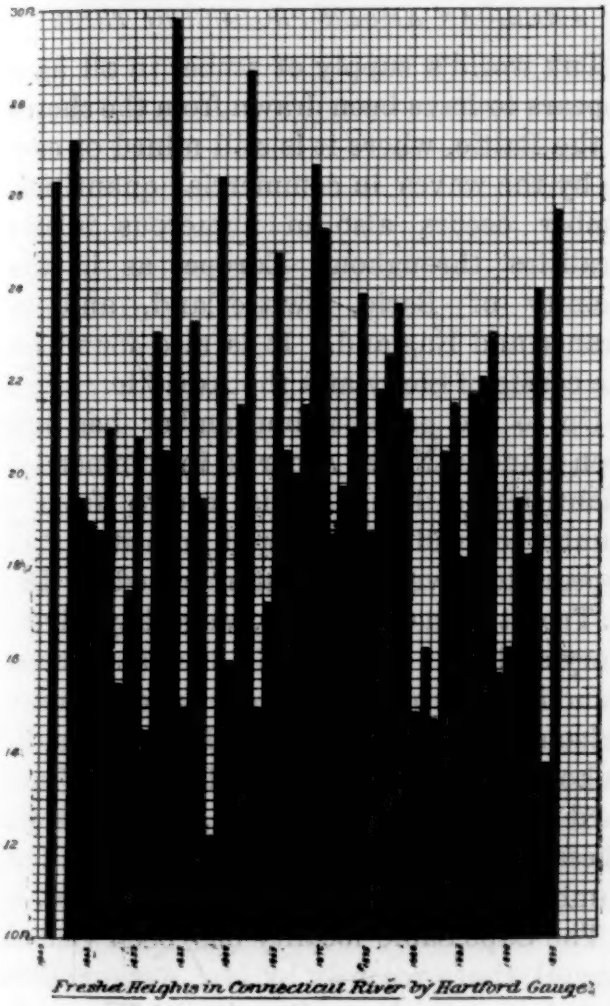
The effect of forest cutting within the past twenty-five years should, of course, be most evident in the upper river, since it is near the head waters that operations have been mainly conducted in that period. It will be of interest, however, to study the only records that are available—those for the lower river—and see if we can there detect any marked change in the nature of its flow.

The theory as to the effect of forests is, that by shading the ground they tend to prolong the melting of snow in the spring, and thus to prevent excessive freshets, as well as to maintain the naturally decreasing flow of late spring and early summer. Further, by reducing the evaporation from the ground, by obstructing the free flow of surface water after rains, as well as by conserving the snows, they tend to maintain a large volume of ground water, which, issuing in visible springs or in invisible seepage, must of course be the reliance of all streams in dry weather. The effect of extensive forest-cutting might, therefore, be expected to be an increase in the number, suddenness, and height of oscillations, and on the other hand a more speedy falling away in summer and a lower range of dry weather flow. To reveal clearly any permanent change that may have taken place in the Connecticut river it seems to me that we should have continuous records of flow for a longer period than they are yet available, and that for successive groups of years curves should be constructed, by averaging for each group the lowest daily discharge, the second lowest, and so on, irrespective of calendar order. The distribution of the flow would thus be shown in a manner warranting the drawing of positive conclusions. Because the labor involved in such a treatment is large, and because the records cover so short periods as hardly to warrant it, I have limited myself to an examination of freshet heights and of low-stage flow.

The heights above low water datum to which the river has risen in freshets at Hartford since 1840 are as follows:

	1841......26.3	Apr.	1869......26.7
	1843......27.2	"	1870......25.3
Dec.	1844......19.5	May	1871......18.7
Apr.	1845......19.0	Apr.	1872......19.7
Mar.	1846......18.8	"	1873......21.0
Apr.	1847......21.0	Jan.	1874......23.9
Jan.	1848......15.5	Apr.	1875......18.7
Nov.	1849......17.5	"	1876......21.8

May	1850......20.8	Mar.	1877......22.6
Jan.	1851......14.5	Dec.	1878......23.7
Apr.	1852......23.1	May	1879......21.4
Nov.	1853......20.5	Apr.	1880......14.9
May	1854......29.8	May	1881......16.3
Jan.	1855......15.0	"	1882......14.8
Aug.	1856......23.3	Apr.	1883......20.5
Feb.	1857......19.5	"	1884......21.5
Mar.	1858......12.3	"	1885......18.2
"	1859......26.4	May	1886......21.8
"	1860......16.0	Apr.	1887......22.1
Apr.	1861......21.5	May	1888......23.1
"	1862......28.7	Nov.	1889......15.7
May	1863......15.0	Oct.	1890......16.3
Apr.	1864......17.3	Apr.	1891......19.5
Mar.	1865......24.8	Jan.	1892......18.3
Feb.	1866......20.5	May	1893......24.0
Apr.	1867......20.0	Apr.	1894......13.8
Mar.	1868......21.5	"	1895......25.7



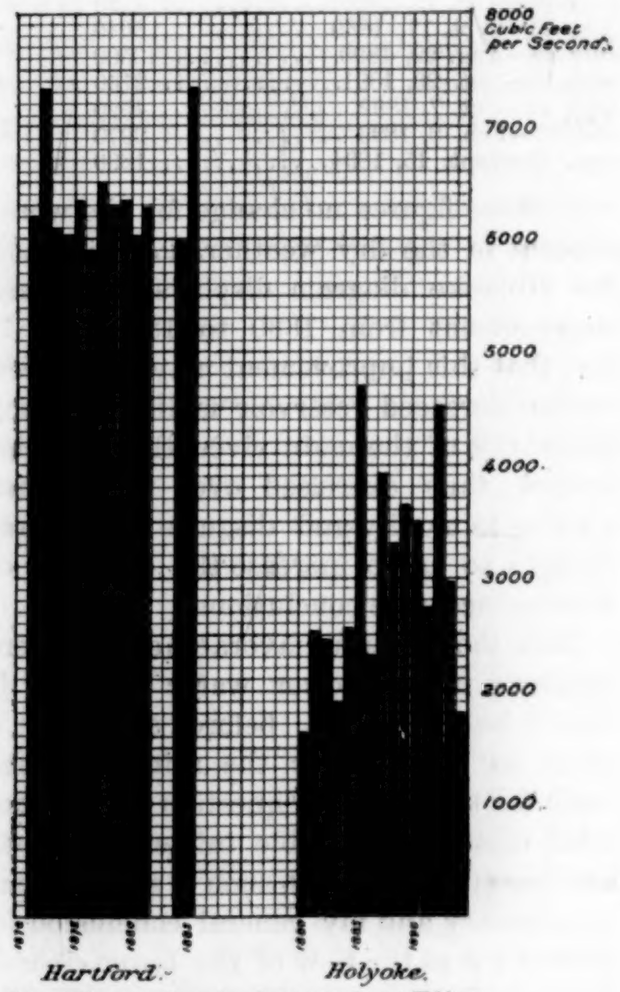
Freshet Heights in Connecticut River by Hartford Gauge.

Averaged for successive periods these give:

1841–49	Average height.......20.6	(1842 missing.)
1850–59	" " 20.5	
1860–69	" " 21.2	
1870–79	" " 21.7	
1880–89	" " 18.9	
1890–95	" " 19.6	

An examination of these figures and of a graphical representation of the yearly freshet heights discloses, it seems to me, no permanent change. The highest freshet was in 1854, the lowest in 1858, and only twice has the height of 27.7 feet attained in 1801 been exceeded. Apparently there was a gradual increase in the *average* height down to 1880, while at the same time there was a marked and steady decrease from 1854 to 1880 in the heights of the more extreme freshets.

In considering the dry weather discharge of the river I have taken as a basis for comparison the average flow for the lowest consecutive period of four weeks in each year, for which I find the following figures, which have also been plotted to scale:



Low Water Flow in Connecticut River.

Connecticut River at Hartford.

	Avg. discharge in cu. ft. per sec. for lowest 4 weeks period.
Sept. 9—Oct. 6, 1871	6200
Feb. 11—Mar. 9, 1872	7330
Aug. 25—Sept. 21, 1873	6090
Oct. 24—Nov. 20, 1874	6020
Jan. 6—Feb. 2, 1875	6330
Aug. 11—Sept. 7, 1876	5900
Jan. 1—Jan. 28, 1877	6490
Sept. 25—Oct. 22, 1878	6280
Oct. 5—Nov. 1. 1879	6350
Sept. 30—Oct. 27, 1880	6020
Sept. 22—Oct. 19, 1881	6270
Sept. 8—Oct. 5, 1884	5960
Sept. 17—Oct. 14, 1885	7320

Connecticut River at Holyoke.

	Avg. discharge in cu. ft. per sec. for lowest 4 weeks period.
Aug. 22—Sept. 8, 1880	1620
Sept. 19—Oct. 16, 1881	2510
Aug. 20—Sept. 16, 1882	2470
Sept. 2—Sept. 29, 1883	1890
Sept. 7—Oct. 4, 1884	2550
Feb. 28—Mar. 27, 1885	4690
Aug. 27—Sept. 24, 1886	2310
Sept. 23—Oct. 20, 1887	3930
July 16—Aug. 12, 1888	3290
Aug. 21—Sept. 17, 1889	3640
July 26—Aug. 22, 1890	3500
Sept. 23—Oct. 20, 1891	2740
Sept. 10—Oct. 7, 1892	4520
Jan. 12—Feb. 8, 1893	2970
Aug. 19—Sept. 15, 1894	1800

In these figures no change for the worse appears in the dry weather flow; in fact, the Holyoke diagram displays a general improvement from 1880 to 1893. It is true that this improvement may have been due to increased reservoir facilities on the tributaries of the main river, the artificial control thus exercised over the stream tending to modify and disguise all natural changes so as to increase the difficulty of drawing accurate conclusions.

Even though an unfavorable change were apparent in the lower water volume, it would be necessary, before assigning a cause for it, to study the rainfall of the basin for the period in question and to consider what the probable influence of that had been; but, as it is, such a study seems unnecessary and my general conclusion is, that so far as the flow of the lower river is concerned, no permanent change for the worse in the past twenty-five years is apparent. In closing I desire to express my indebtedness to Mr. F. H. Newell, Secretary of this Association, for placing at my disposal valuable data regarding the discharge of the Connecticut river; and to call attention to the importance of the work being done by the United States Geological Survey in attempting to obtain continuous records of the flow of many of the rivers of this country.

DWIGHT PORTER.
MASSACHUSETTS INSTITUTE OF TECHNOLOGY, BOSTON.

AMERICAN AMBER-PRODUCING TREE.

THE world's supply of amber in all ages appears to have been drawn from the shores of the Baltic, where it is still mined or cast up by the waves in commercial quantities. Amber occurs also in numerous inland localities throughout Europe, as in the vicinity of Basle, Switzerland, and in France and England. It is also found on the coasts of Sicily and the Adriatic.

Up to the present time amber has not been found in North America in commercial quantities, although it is known from a number of widely scattered localities. It appears to have been first reported by Dr. G. Troost from Cape Sable, Magothey River, Maryland, in 1821. * It has also been found in small quantities near Cañon Diablo, Arizona; near the Black Hills, in South Dakota; Gay Head, on Martha's Vineyard; Trenton and Camden, New Jersey; Chesapeake and Delaware Canal, and a number of more or less doubtful localities.

The Cape Sable locality has been visited several times recently by Mr. Arthur Bibbins, instructor in geology in the Woman's College of Baltimore, and a careful search made for the amber.

This place is somewhat difficult of access from Baltimore, and the visits to it were made possible by the courtesy of Dr. W. L.

* Am. Journ. Sci., Vol. III. 1821. pp. 8–15.

Rasin, of Baltimore, who placed his commodious tug at Mr. Bibbins' disposal for the investigation.

A number of small pieces of amber were found *in situ* in thin strata composed largely of comminuted lignite. By careful excavation Mr. Bibbins was able to expose a log of lignite which showed in several cases the amber in its interstices. Through the kindness of Mr. Bibbins I have been enabled to investigate the structure of this amber-producing tree.

This log was found about 20 feet below the surface in strata provisionally regarded by Mr. Bibbins as of upper Potomac (upper part of Lower Cretaceous) age. About 4 feet in length of the log was taken out. It was very soft when excavated and hardly to be distinguished from the surrounding matrix. When dried by exposure to the air it becomes thoroughly disintegrated into minute fragments, and even when treated by hardening substances still retains so much iron pyrites that it appears impossible to stop its reduction to powder. Before fossilization the log had been completely honeycombed, apparently by a Teredo-like mollusk. This condition made its compression easy, and when excavated it was found to be much flattened. It was about 14 inches in long, and 6 inches in short diameter.

When observed with the naked eye or with a low-power lens the wood appears to be admirably preserved. The grain shows very clearly and, when it is split radially, faint traces of the medullary rays can be made out. It is very soft and may be sliced with an ordinary razor without treatment of any kind. But when studied under a compound microscope it is found at once that much disintegration and distortion has taken place. The wood cells have been flattened and crushed until it is quite impossible to make out their character. Figure 1, magnified 320 diameters, represents the lumen of the cells. It is impos-

FIG. 1.

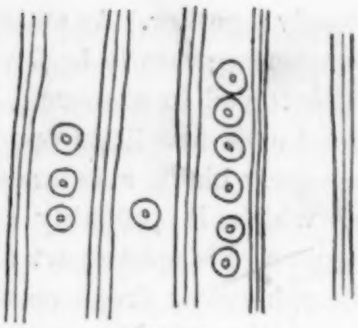


FIG. 2.

sible to make out their outline or to determine whether or not there were rings of growth.

The radial section appears the best preserved of all. An exceptionally well preserved portion is shown in figure 2. It shows the cell walls to be thick, and also that the radial walls are provided with a single series of large pits. The outlines of the outer and inner circles are so obscure that it is not possible to make satisfactory measurements. (In the drawing they of course appear distinct, but they are only approximate.) The medullary rays should be observed in longitudinal section, but they can not be made out with sufficient distinctness to be drawn with the camera. The usual number appears to be four, but it may vary from two or three to as many as seven.

The tangential section, of which a fragment is given in figure 3, shows the extent

FIG. 3.

FIG. 4.

to which the medullary rays have been compressed. The opposite walls are pressed

closely together. As stated above, the usual number appears to be four.

Scattered in numerous places among the wood cells are little opaque spheres of an intensely black substance (shown in figure 4) which is probably amber. Two contiguous cells split apart and in the interval the spheres or drops occur. This intimate association of these, as well as that of the undoubted pieces of amber, leave no doubt that they are found in connection with the tree which produced them.

This amber-producing tree was of course coniferous, but the poor state of preservation renders its generic determination more or less open to question. The Baltic amber-producing trees, of which some six species are known from studies of the internal structure, were pines (Pinites), but no evidence could be found to show that the one under discussion belonged to this group. Indeed, it is hardly to be expected that the genus would have had the same peculiarities from the lower cretaceous to the oligocene, the age to which the Baltic amber belongs. The large resin tubes and compound medullary rays are characters of the pine group, but are absent in this. On the other hand, as nearly as can be made out, the structure is that of Sequoia or Cupressinoxylon as the wood is known in the fossil state. It is very much like certain lignites that have been described from the Potomac formation, but of which too little is still known. This view is further strengthened when it is remembered that some fifteen species of Sequoia are already known, from the researches of Fontaine, to have lived during Potomac times.

I venture to propose for this American amber-producing tree the provisional name of *Cupressinoxylon? Bibbinsi*, in honor of the collector, who has done so much to elucidate the complex history of the Potomac formation and its vegetation.

F. H. KNOWLTON.

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*ZOÖLOGICAL NOMENCLATURE—A PROPOSAL.**

THE discussion on zoölogical nomenclature, which was held, as announced in our last number, by the Zoölogical Society of London on March 3d, was introduced to a crowded meeting by Mr. P. L. Sclater, F. R. S., in a concise and careful paper, and the points to which he drew attention were warmly debated beyond the usual hour. The discussion dealt with certain differences between the rules drawn up by the German Zoölogical Society for the guidance of the compilers of the Synopsis of the Animal Kingdom ('Das Tierreich') which that Society is preparing, and the rules known as the Stricklandian Code, which for many years governed, or were supposed to govern, the usage of British naturalists. The discussion turned chiefly upon the following questions: First, may the same generic names ever be used for both animals and plants? Secondly, may the same term be used for the generic and trivial name of a species, as in the well-known instance of *Scomber scomber?* Thirdly, are we to adopt as our starting point the tenth edition of Linné's *Systema Naturæ* in preference to the twelfth edition? These questions are answered in the affirmative by the German code, and in the negative by the original Stricklandian. We do not propose to discuss them here: it is natural that there should still be found, especially among the older zoölogists of this country, many to support the old-established British practices; in this, as in all other matters of nomenclature, convenience, not principle, is concerned, and it cannot be gainsaid that the general usage of zoölogists, at all events in other parts of the world, becomes daily more and more in harmony with the rules adopted by the German Society.

Were we again to open our pages to the discussion of this thorny subject, we should

*From proof sheets of an editorial article in *Natural Science*.

probably prefer, as did many of those who spoke at the Zoölogical Society's meeting, to discuss points that appear of more vital importance; but after listening to the various ingenious arguments, and to the animated rhetoric, punctuated by shouts of applause, that were poured forth the other evening, we felt more inclined than ever to doubt the value of these discussions. There are, it appears to us, fundamental defects that so far have pervaded all of them. A casual glance at the list of modern codes of nomenclature exhibited by Mr. Sclater was enough to show how very limited has been the authority of those bodies that have, from time to time, ventured to suggest laws for the zoölogical world. Either it is a committee of a section of the British Association, or it is the Zoölogical Society of France, or of Germany; or, again, at one moment we find the ornithologists meeting in conclave, at another the paleontologists, at yet another the neontologists; even when we see a code drawn up and passed by two International Congresses of zoölogy, we must not, as the President pointed out, flatter ourselves that more than a very few of the actual workers have assented, or have even been consulted. Consequently, the best of the codes that has yet been proposed (and which that be, each reader must decide for himself) has lacked the authority and the sanction that alone can make it of value. For we must insist upon this point, if upon no other, that it is not the wording of any particular law that is of consequence, but the power of enforcing it. We venture to say that to the very best code that could possibly be drawn up each individual zoölogist would remain a recalcitrant, were it only in so trivial a point as the insertion of a comma or the use of a capital letter.

If it be true that we come to some such *impasse* in whatever direction we proceed, it is worth considering whether we cannot follow some course more productive of finality than is this perpetual codifying of our whims and fancies. And here we would take up and push to their logical conclusion the suggestions that were thrown out at the meeting by Mr. H. J. Elwes and the President. It is not enough to imitate Mr. Elwes, and to follow the last monograph or the last catalogue of some great museum; for other monographers will arise, and rival museums will publish rival catalogues, each with its own system of nomenclature. Nor is it of much use to follow those British ornithologists of whom the President told us, who some years ago made a vow to adopt such and such fixed names for all the British birds; for the science of zoölogy is not confined to these islands, and those who withdraw from the main stream of progress will either find themselves left high and dry, or be forced to rejoin it as laggards and out-of-date. But the course that might be pursued is suggested to us by this very enterprise of the German Zoölogical Society. Let us suppose that, instead of shrinking from the magnitude of the undertaking, instead of insinuating its impossibility, and instead of drawing their purse-strings tighter, the zoölogists of the world were to give a mandate to the German Zoölogical Society to proceed with the work, and were to assist them generously by every means in their power, then we should have a complete set of names for all living species of animals. This, it is true, would not be enough. To draw up such a correct list of names without consulting the paleontologists is impossible, and, even were such a list drawn up, it would, for the purpose we now intend, be valueless. But let us further suppose that some body, such as the German or the English Zoölogical Society, could be found to draw up a list of all animal species, fossil as well as recent, then it would at all events be perfectly possible for the zoölogists of the world to accept that list, and to

say: "Whether these names be right or wrong according to this or that code of nomenclature, we do not know and we do not care; but we bind ourselves to accept them in their entirety, and we hereby declare that the date when this list was closed for the press shall henceforward be the date adopted as the starting point for our nomenclature."

We have put this proposition in a broad manner; there are, of course, numerous minor points to be taken into consideration. The preparation of a mere list would be an enormous undertaking; we learn from Dr. David Sharp and the workers on the *Zoölogical Record* that there are 386,000 recent species; no one has reckoned the number of extinct species. Some such work as the 'Index generum et specierum animalium,' now being compiled with a minimum of support and under constant difficulties by Mr. Charles Davies Sherborn, must form the basis of any such synopsis as that here proposed. The first duty of naturalists is to help Mr. Sherborn, who works at the British Museum under a Committee of the British Association. We also have to consider what is to be done when our list is completed. First of all, it must constantly be kept up to date. It seems to us that some restriction will have to be laid upon the place and manner of publication of new specific names, and we would suggest that, when the time comes, no specific name should be recognized unless it be entered by the author at some central office, together with a properly published copy of the work in which the description appears. The name would then be checked, dated, and placed at once in the index.

It is not contended that the acceptance of our proposal would obviate the need for a code of nomenclature. But it would be a far simpler code, free from the doubt as to whether its rules were to be retrospective; and its action would be uniform and stringent. Nor is it contended that the validity of a name carries with it the validity of a species. For the stability of nomenclature, it would be advisable to include in the list as many names as possible, and to leave to specialists the duty of deciding on the distinctness and systematic position of species. But whether our aim be the completion of an Index, the compilation of a Synopsis, or the construction of a Code, it is necessary that there should be absolute and loyal coöperation between zoölogists of every kind and every country, since by this means alone can the required sanction be obtained.

CURRENT NOTES ON ANTHROPOLOGY.

THE CHILD MIND AND THE SAVAGE MIND.

Prof. James Sully, who fills the chair of 'philosophy of mind,' in University College, London, makes it a point in his recent work, 'Studies of Childhood,' to institute frequent comparison between the mental action of children and of savage adults. A few of his conclusions may be mentioned:

On the important question of the origin of languages he is not quite positive. He believes children 'show the germs of true grammatical feeling,' and believes "they might develop the rudiments of a vocal language;" but elsewhere quotes with seeming approval Max Müller's assertion that they could not do this, 'if left to themselves;' which begs the whole question. Unfortunately, Prof. Sully has not read Mr. Horatio Hale's admirable studies. He quotes them only at second hand.

Death presents itself to the child just as the savage. It is not annihilation, but a continued existence, partly with the body, partly separate from it. The lower animals live after death just as do human beings. The individuality to the child, as to the savage, is multiple, not single, whether in life or death.

The colors first recognized and most en-

joyed by children are red and yellow, and bright, glistening objects are equally attractive to both.

POINTS IN PRACTICAL ANATOMY.

In the Bulletin of the Anthropological Society of Paris, for December, 1895, Dr. Chudzinski studies the radical differences presented by the rectus abdominis muscle. It is highest developed in the white race, least in the yellow race, while in the black race it is intermediate. Its anomalies and irregularities are more numerous in the colored races, and its intersections are higher in both these reaching their maximum in black women.

In the same Bulletin Dr. Montard-Martin reports observations on congenital and hereditary malformations of the fingers and toes. He reaches the general conclusion that these deformities are transmitted most directly and persist longer in the descendants of the same sex as the person transmitting them; *i. e.*, if derived from a maternal ancestor they will first disappear in the male decendants and *vice versa*.

THE ANCIENT ILLYRIANS.

According to Frederick Müller, the Illyrians were the first to separate from the primitive Aryan stock, and left their Northern home to settle in the Balkan peninsula and on the coasts of the Adriatic Sea (*Allgemeine Ethnographie*, p. 70).

They have, therefore, a peculiar interest to students of Aryan ethnography, and the recent researches into their ancient sites and tombs merit attention. They are reported upon by Hedinger in the March number of the *Correspondenz-Blatt*. One of the largest cemeteries is Glasinac, 45 kilometers southeast of Sarajèvo. It contains 20,000 graves, chiefly dating from the bronze and early iron period. Glass, enamel and amber abound, but the pottery is comparatively rude, none of it being made with the potter's wheel. The oldest graves take us back at least 1000 B. C., or about the time of the Homeric wars. Even then the Illyrians were a sedentary, agricultural people, acquainted with metals and fairly advanced in the arts. They flourished without serious interruption until about 400 B. C., when they were almost destroyed by the Celts, who at that time overran southern Europe. The modern Albanians, or Skipetars, are the descendants of those who escaped the disaster.

THE ETHNOGRAPHY OF BURMA.

The supposed discovery of relics of tertiary man in Burma, by Dr. Nöthing, gives interest to the recent researches into the ethnography of that land.

The present population represents two strata of immigration. Much the oldest is that to which belong the Khmer, the Mon and similar tribes. An investigation of their dialects (principally by F. S. Forbes and E. Kuhn) revealed the unexpected result that they are members of the Kohl family of central and northern India, belonging therefore to the 'Dravidian' group.

The Burmese proper claim to be descended from the Indian Kshatryas; but this is incorrect. They are remarkably similar in physical type and temperament to the Tibetans; and in the Journal of the Royal Asiatic Society, January, 1896, Mr. B. Houghton shows that their language is a Tibetan dialect, and that they migrated from the western end of the Tibetan plateau many centuries B. C. Even then they were agricultural, knew iron and other metals, and had extended trade relations.

The peculiar ancient stone implements found in Burma, of the form known as 'shouldered celts,' asymmetric antero-posteriorily are shown by A. Grünwedel (in 'Globus,' Bd. 68, No. 1.) to be of the same size and shape as others from the Kokl territory of India.

D. G. Brinton.

NOTES UPON AGRICULTURE AND HORTICULTURE.

SOIL IRRIGATION.

A good deal is being done in the experiment stations in the application of water to soils for purposes of crop growing.

From the last issue of the Experiment Station Record (Vol. 7, No. 6), under the head of agricultural engineering, particular mention is made of experiments in irrigation at the Utah Station. Under farm irrigation it is gathered that two feet of water is required for best results with grains upon clay soil, while a sandy soil needs three and a half feet. For wheat, clover and timothy the intervals between irrigation should be about twelve days. With spring wheat there was a decrease of yield when there were more than three waterings. Better results are obtained by day than by night irrigation. Fall watering favored timothy, but not winter wheat. The flooding system is superior to the method by furrows, and the acre-foot unit is recommended by Professor Mills for general adoption.

Under orchard and vineyard irrigation Professor Richman holds to the opinion that the best plan is to apply the water but a few times, supplying enough to reach the deeper roots of the trees. Young trees require more frequent watering than old ones, and the opinion is erroneous that water injures the trunk of trees even when confined around the base by heaped-up earth.

Among other bulletins cited is one (No. 25) from the Nevada Station, largely a compilation from publications of the Colorado and Wyoming Stations, etc., which deals with water storage measurements, pumping, etc. Another is No. 6 of the Montana Station, upon measurements of water, giving value of water, water duties and tables for discharge over weirs. Several other items are given upon this general subject from Kansas and Washington.

There is a manifest growing interest in agricultural engineering, as it relates to the distribution of water over the soil.

While irrigation has been and will continue to be a leading feature of agriculture in the arid regions of the West, there is little doubt that it will also increase in importance in the East. Field irrigation may not become a common practice along the Atlantic coast, but it seems likely that methods will be provided for supplying water to truck and berry fields when there is a shortage due to drouth.

In a small way experiments with garden crops have been carried on during the past summer at the New Jersey Station, and the results published in bulletin No. 115. From the summary the following facts are gathered: "Irrigation is quite favorable to bush beans, there being nearly three times as many pounds of pods upon the belt receiving water as elsewhere in the field, besides the quality was superior. * * * Irrigation prolonged the period of fruitfulness of peppers and the yield was nearly doubled. * * * Irrigation greatly increased the leaf development of turnips, and probably there would have been a corresponding growth of roots were it not for the clubroot which practically ruined the crop. * * * Irrigation for celery gave satisfactory results. * * * In marketable product in pounds the difference was three to one, and in marketable value eight to one, in favor of irrigation." Equally good results may be hoped for with strawberries should there be a dry spell just preceding fruiting time.

Irrigation in the greenhouse is taking shape by means of tiles or pipes with frequent outlets within the soil, that is, the various experiments at the Ohio, Cornell, West Virginia and other Stations all point toward the watering of greenhouse-grown plants from below or by what is termed sub-irrigation.

THE FIRST PRINCIPLES OF AGRICULTURE.

THE above is the title of a neat book of over two hundred pages by Edward B. Vorhees, Professor of Agriculture in Rutgers College and Director of the Experiment Stations of New Jersey. In a clear and attractive manner the important first principles of the crop growers' craft are taken up in logical order. There are fifteen chapters, beginning with the plant constituents and running through the formation of soils, their composition and improvement, and natural and artificial manures. To the latter fully a quarter of the book is devoted, there being a chapter each upon nitrogenous materials, phosphates, superphosphates and potash, salts and methods of buying, etc. Rotation of crops, selection of seed, growth of animals, feeds and fodders, principles of breeding and products of the dairy, complete the list of general subjects treated. To this is added composition and coefficient tables as an appendix, closing with an index.

The author has felt the need of a work like this in his college teaching, and in connection with his work among the farmers themselves. Prof. Voorhees believes that agriculture can be taught in the country schools and "it is here that such education must begin if it is to reach and influence the masses of farmers." With this conviction and the endorsement of the New Jersey Board of Agriculture and State Grange the work has been prepared. It is, however, a book for any farmer, for the contents deal with those general principles that know no State or country. Great stress has been laid upon fertilizers, for Prof. Voorhees, from his especially large experience in this branch of the work, sees that a clear understanding of manures, in the broad sense, and their rational use, lie at the bottom of all future successful agriculture in this country.

BYRON D. HALSTED.

CURRENT NOTES ON PHYSIOGRAPHY.

THE ECONOMIC IMPORTANCE OF PENEPLAINS.

THE relation of geological deposits that have economic value to physiographic conditions, ancient and modern, has often been illustrated. Coal beds record ancient lowlands with extensive marshes of imperfect drainage. In Pennsylvania the preservation of the coal now remaining is due to its having lain all through Mesozoic time out of reach of the weather, that is, beneath baselevel; for practically all the coal there is below the level of the Cretaceous peneplain of that region. Again, the limonite iron ores of the Appalachian valley are products of leaching on surfaces of low grade, the floors of Tertiary valley lowlands, now uplifted and more or less dissected. A recent essay by Hayes (16th Ann. Rep., U. S. G. S.) shows that the Georgia and Alabama pocket deposits of bauxite, the oxide of aluminum and an important source of this metal, are limited to the Tertiary lowland of the Coosa valley; thus again exemplifying the same general principle. The source of the deposits is thought to be in the underlying Cambrian shales; the faults of the regions afford paths for upward transportation; and the low grade of the former valley lowland promoted local accumulation in pockets. Similar deposits may have been formed on the more ancient Cretaceous peneplain of the region; but these have vanished with the uplift and great dissection of that lowland. Similar deposits may in future be formed when the narrow valley trenches of to-day shall have widened into broad floors. But at present the bauxite pockets are practically limited to the unconsumed portions of the Tertiary valley lowland. Hence they stand at altitudes of about 850 feet, although ranging across the bevelled edges of several thousand feet of strata. As a guide in searching for new localities, this generalization is of manifest value.

DETRITAL SLOPES IN ARID REGIONS.

An excursion into eastern California, inland from the Sierra Nevada and north of the Mohave desert, is described by H. W. Fairbanks in the *American Geologist* for February. The chief mountain ranges are held to be uplifted blocks, little dissected; the form that they had before uplift does not appear to have been considered. The long slopes of coarse detritus reaching forward from the mountain flanks into the desert valleys, constitute characteristic features of the region, as has been pointed out by various observers. Alluvial fans occur with a radius of from six to twelve or fifteen miles. Laterally confluent fans form nearly uniform slopes. A granite ridge south of El Paso range is almost buried in its own waste; the long marginal slopes of gravel and boulders extend headwards into the shallow cañons and reach almost to the ridge summits. Viewed from a distance of ten miles, but little of the granite appears to project above the gravel slopes.

Following a use of terms that needs reform, Fairbanks mentions this ridge as an excellent example of baselevelling. But is it not manifest that, even when the heads of the granite mountains are worn down still lower, the general surface of the detrital slopes will continue to suffer slow degradation for a long time; and furthermore, if the climate of the district had been rainy, is it not true that the existing slopes would not have been assumed. The graded form that the region has almost reached is a function of time and climate as well as of altitude with respect to baselevel. These important topographic controls are neglected if the region is said to be baselevelled.

THE ICE FALL ON THE GEMMI PASS.

The ice fall from near the summit of the Altels peak, southeast of the Gemmi pass, on September 11th, last, is now fully mapped, figured and described by Heim in a most interesting report made to the Swiss glacier commission (Die Gletscherlawine an der Altels, Zurich Naturf. Gesellsch. Neujahrsbl. 1896.) About four and a half million cubic meters of ice slid down an incline some four kilometers long, descending from 3,200 to 1,900 meters above sea level. Gathering about a million cubic meters of rock waste on the way, the gliding mass ran across the valley floor, dashing far up the opposite slope and falling back again, like a wave from a cliff. Finally settling, the debris occupied a square kilometer of surface to an average depth of five meters. A bench on the path of the sliding ice two hundred meters above the valley caused it to spring forward, like a boy's sled passing a 'hump' in his coast, for a time clear from the ground; then falling, the air beneath it was violently driven out to either side, bearing fragments of ice and stones and overturning trees for several hundred meters laterally and forwards, and thus nearly doubling the area afflicted. As in all Heim's work, the pictures gain great value from being drawn and lithographed by his own hand. One of the photographs represents the genial Zurich professor standing on the ice conglomerate.

INTERGLACIAL VALLEYS IN FRANCE.

Marcellin Boule has recently made an interesting communication to the French Academy on the older and younger—pliocene and quaternary—glaciation of Auvergne (Comptes Rendus, December 2, 1895), from which it appears that the valleys of the elevated plateau of central France were excavated during a nonglacial interval. The upland bears extensive deposits of morainic material with scratched stones of all sizes and numerous *roches moutonnées*, implying an extensive glaciation. Beneath this upland, valleys are trenched to a depth, two, or even three hun-

dred meters. In the valleys lie the moraines of local glaciers, to which reference has frequently been made by various observers.

MISCELLANEOUS.

Appalachia for January contains well illustrated narratives of ascents in the Canadian and Montana Rockies, and the California Sierra. The photographs by the Topographical Survey of Canada exhibit the great extent of lofty mountainous country in which deep valleys are dissected.

THE *National Geographic Magazine* (now issued monthly) for January, February and March contains descriptive articles on Russia by G. G. Hubbard, Venezuela by W. E. Curtis, Arctic exploration by S. Jackson, A. W. Greely and W. H. Dall, the Panama and Nicaragua canals by R. T. Hill and A. W. Greely, Tehuantepec ship railway by E. W. Corthell, the submarine cables of the world by G. Herrle, and the survey of Indian Territory by H. Gannett. Geographic literature and notes are briefly treated in each number.

AN abstract of explorations by Obruchef in central Asia is given in the *Scottish Geographical Magazine* for February. It emphasizes the mountainous character of much of the desert of Gobi, which was treated as a plain in older descriptions. "A marked peculiarity of many chains in central Asia is that they stand on high broad pedestals insensibly sloping down to the low central parts of the depressions." This is probably an incorrect interpretation of ranges nearly buried in alluvial wash.

THE same journal for March gives a sketch of British Guiana, by Chalmers, briefly characterizing the coastal plain, the inner highlands and their mountains, and the falls of the rivers in their descent from the higher to the lower district. Roraima and Kailteur are outlined.

VAUGHAN'S journeys in Persia are narrated in the London *Geographical Journal* for January and February. Special account is given of the Dasht-i-Kavir, or Great Salt desert, 360 miles east-west by 150 north-south, with a central depression one or two thousand feet below its margin, and including a great salt bed 440 square miles in area.

THE same journal for February has a paper on the Japanese Alps by W. Weston, speaking highly of their picturesque scenery. They consist of a backbone of granitic rocks, through or over which vast quantities of volcanic rocks have been poured.

W. M. DAVIS.

HARVARD UNIVERSITY.

SCIENTIFIC NOTES AND NEWS.

MR. WILLIAM I. HORNADAY, formerly of the National Museum, has been appointed Director of the proposed Zoölogical Park in New York. He is eminently qualified for the position by his extensive knowledge of zoölogy, his ability as an untechnical writer upon travel and natural history, and especially by his experience in connection with the establishment of the National Zoölogical Park at Washington. He enters upon his duties immediately and will first consider and report to the Executive Committee upon the difficult question of location of the Park. At the last meeting of the Society the three first honorary members were elected as follows: Sir William H. Flower, Director of the British Museum of Natural History, President of the London Zoölogical Society; Prof. Alexander Agassiz, of the Museum of Comparative Zoölogy, and Prof. J. A. Allen, of the American Museum of Natural History.

THE first session of the Bahama Biological Station under the direction of Prof. Charles L. Edwards, University of Cincinnati, was held during the summer of 1893, at Bimini Islands, Bahamas. For the coming season it has been decided to locate the laboratory at Biscayne Bay, Florida, in the latitude of the Bimini Islands, and just across the Gulf Stream. Here is found the same equable climate, clear water and sub-tropical fauna and flora, for which the Bahamas are famous. An all-rail route of two

days, at excursion rates, gives the more accessible Florida location a decided advantage. The Station is open to a limited number of investigators, teachers and students in biology. The session will begin Monday, June 22, 1896, and continue six weeks. The course of instruction consists of lectures, dissection and microscopic work in the laboratory, with observation of the organisms in natural environment. In order to supply students, or institutions at a distance, with materials for practical work, a collecting department has been established. Orders for laboratory material, or applications for admission to the Bahama Station, should be made to the director before June 1st.

THE bill appropriating $500,000 for an additional wing for the American Museum of Natural History has been signed by Governor Morton. This, in addition to the wing now in course of construction, and the wing recently opened to the public, will make the Museum one of the finest in the world. The new wing will be in the form of an 'L' completing the 77th street front and extending a short distance along Central Park.

A PROVISIONAL Committee has been formed in England to promote the International Memorial to Pasteur. The Executive Committee consists of Sir Joseph Lister, Sir John Evans, Sir Henry Roscoe, Dr. Thorne Thorne and Prof. Percy Frankland (Honorary Secretary).

AT the annual meeting of the American Philosophical Society, at Philadelphia, on May 1st, the meeting will be devoted to a discussion of 'Evolution,' in which Professors Cope, Minot and Bailey will take part.

THE following is the program of lectures before the National Geographical Society for April and May: April 6 (sixth Monday afternoon), 'From Sitka to the Sunset,' Mr. Marcus Baker, of the U. S. Geological Survey; April 10 (special Friday afternoon), 'Cuba as Seen by a War Correspondent,' Capt. Wm. F. Mannix; April 13 (seventh Monday afternoon), 'A Journey in the Interior of Alaska, Prof. I. C. Russell, of the University of Michigan; April 17, 'The Geography, Scenery and Resources of Idaho,' Hon. Fred E. Dubois, U. S. Senate; April 24, 'Progress of Africa since 1888, with Special Reference to South Africa and Abyssinia,' Hon. Gardiner G. Hubbard; May 8, 'Geography as Illustrated by Precious Stones,' Mr. George F. Kunz, of Tiffany & Co., New York. The total membership of the Society is now 1,374, consisting of eleven honorary, 1,070 active and 293 corresponding members.

THE death is announced of M. Julius Belleville, an eminent French inventor.

THE bill before the House of Representatives adopting the metric system of weights and measures as legal standards in the United States has been referred back to the committee. The Bill was ordered to a third reading by a vote of 119 to 116, but this vote was afterwards reconsidered.

DR. WILKES has been elected President of the Royal College of Physicians, London, the final vote standing 114 for Dr. Wilkes and 32 for Sir William Broadbent.

MR. HENDRICK R. HOLDEN has been appointed New York State Fish, Game and Forestry commissioner.

THE Huxley Memorial Committee will be glad to receive designs for a medal to be awarded by the Royal College of Science, London. Further particulars will be furnished on application, which must be sent in before May 1st to the honorary secretary of the Huxley Memorial Committee, Prof. G. B. Howes, Royal College of Science, South Kensington, S. W.

WE learn from *Nature* that Prof. Wyndham R. Dunstan has been appointed Director of the Scientific Department of the Imperial Institute, which has hitherto been under the direction of Sir Frederick Abel. Prof. N. A. Moor of the Elphinstone College, Bombay, has been selected for the post of Director of the Government Observations at Colaba, in succession to the late Mr. Charles Chambers.

ARRANGEMENTS are being made for a tour abroad by a hundred American physicians, who will visit during the coming summer the principal health resorts of Europe. It is expected that various courtesies will be shown them at the places visited.

THE fourth International Hydrological, Cli-

matological and Geological Congress will be held at Clermont-Ferraud at the end of September, 1896.

A LETTER signed by Prof. John Caird, Principal and Vice-Chancellor of the University of Glasgow and Sir James Bell, Lord Provost of Glasgow, has been sent to various universities and learned and scientific societies, inviting them to send representatives to the jubilee of Lord Kelvin, which will be held at Glasgow on the 15th and 16th of June next.

AT a meeting of the fellows of the Royal Botanic Society, in London, on March 28th, it was stated that since the gardens have been open to the public on Mondays and Saturdays there has been a good attendance, a total of 6,000 persons having attended on eleven of the Mondays. It had been claimed that fellows would resign if the grounds were open to the public, but instead of that the roll of fellows had been greatly increased. The plan of having promenade concerts in the garden has not been favored by the Council, but will be again considered.

IT is stated that Huxley's library is now offered for sale.

REUTER'S Agency states that the Windward, of the Jackson-Harmsworth expedition will leave again for the Arctic seas early in June. The Windward will carry a budget of letters for Dr. Nansen, on the chance of falling in with him north of Franz Josef Land. More members will be sent out to recruit the Jackson-Harmsworth expedition. The Windward will call at Archangel. The organizers of the expedition are in communication with Mr. Andrée, the projector of the balloon voyage towards the Pole, who, in view of the possibility of his balloon drifting in a southeasterly direction, is receiving full particulars of the depots which have been established by Mr. Jackson.

AT a recent meeting of the British Astronomical Society, a number of papers were read under the title of 'Eclipse Suggestions.' According to the report in the London *Times* Mr. J. Lunt suggested a method of determining the general brightness of the corona. The principle of the method was to photograph a small 'window' through which the coronal light was streaming, and the squares of which varied from clear glass through various degrees of opacity, such that the coronal light was able to penetrate with actinic effect through a square of medium opacity in the time at the observer's disposal during totality. Mr. A. C. D. Crommelin read a note on 'Some of the attendant phenomena of total solar eclipses.' The President also contributed some suggestions, his subject being 'Camera work.' He said that two lessons were suggested by the Californian experiences—namely, the need for mounting the camera very solidly, and the unwisdom of attempting too many photographs. Mr. A. Fowler read a paper and showed twelve lantern slides illustrative of the observations that might be made with a pocket eclipse spectroscope.

D. APPLETON & CO.'s spring announcements include *The Warfare of Science With Theology in Christendom*, in two volumes, by Andrew D. White; *Genius and Degeneration*, by Dr. William Hirsch; *Our Juvenile Offenders*, a new volume in the Criminology Series, by W. Douglas Morrison; *The Intellectual and Moral Development of the Child*, by Gabriel Compayré, and *A B C of Sense-Perception*, by William J. Eckoff, new volumes in the International Educational Series; *Ice Work, Present and Past*, by T. G. Bonney, a new volume in the International Scientific Series; and *Familiar Trees*, by F. Schuyler Mathews.

HENRY HOLT & CO.'s announcements of scientific works include *Electricity*, by Prof. Charles A. Perkine, of the University of Tennessee, and *A Problem Book in Elementary Chemistry*, by E. Dana Pierce, of the Hotchkiss School, Lakeville, Connecticut. The same publishers will add at once to their German Texts Eckstein's *Preisgekrönt*, edited by Prof. Charles Bundy Wilson, of the University of Iowa.

THE experiment about to be made at London of using sea water for watering the streets, flushing the sewers and other purposes will be watched with much interest in America. The Croton system supplying New York City is now being enlarged at much expense, and the additional supply is needed only for a short time during the year when sea water would be of course available. In addition to the possible

economy it is urged that salt water will keep the roads and sewers much cleaner and more wholesome.

THE French Admiralty and a large number of railways and other corporations have adopted the metric system of screw threads recommended by *La Societé d'Encouragement pour l'Industrie Nationale*, of Paris. It is proposed to consider the subject at an international conference at Berne, where it is probable that the new system will be adopted, and in this case the Whitworth system would soon be superseded.

The British Medical Journal states that a water famine is threatened in London. In 1895 the total amount of rain measured at the Royal Observatory, Greenwich, was only 19.73 inches, against an average of 25.06 inches. This deficiency is still in progress in the present year. In February the total rainfall at Greenwich was only 23 per cent. of the average for the month, and at Paris only 16 per cent. During January and February together the value was as low as 65 per cent. short of the mean at Paris, while in London the deficiency was 68 per cent. The rainfall of 1896 in London has so far, in fact, amounted to less than one-third of the average.

IN a paper presented before the Paris Academy on March 23d, MM. le Prince Galitzine and A. le Carnojitzky claim that they have been able to polarize the X-rays by means of tourmalines. Lord Blythswood reported to the Royal Society on March 19th that he had been able to reflect the rays. The most perfect photographs hitherto taken by means of the Röntgen rays are produced in recent issues of the *British Medical Journal* and the *Lancet*, one of a monkey and one of an infant three months old; not only is the skeleton of a child shown with great distinctness, but some of the soft parts are clearly outlined.

PROF. J. C. EWART, of the University of Edinburgh, has undertaken an extended series of experiments upon telegony. He has a mare in foal by a zebra and a zebra mare in foal by a zebra stallion, and has arranged a number of other crosses in which the paternal and maternal characteristics are strong but less easily recognizable than in the above cases. Breeders thoroughly believe in telegony, or the transmission of the influence of a previous sire. A number of apparently authentic cases have been cited besides the famous one of Lord Morton's mare, but none that fully satisfy the most critical. The matter of transmission of characteristics from a previous sire in such an important one that it requires fresh verification, and Prof. Ewart's experiments will be watched with interest.

IN an editorial comment entitled 'The Taming of the Shrews' on the recent monographs by Dr. Merriam and Mr. Miller, *Natural Science* remarks: "In looking through these publications the conviction is forced upon one that 'they know how to do things in America,' and one wonders what work will be left for the poor fellows of the next generation. So far as North America is concerned, at any rate, there will be no new species to discover nor any work to be done in unravelling synonymy, for this is all done so thoroughly by the writers of these monographs. They know, too, how to print books in America; in this, as in their other government publications, both the paper and type are all that can be desired, and might well be commended to the notice of the 'Printers to the Queen's most excellent Majesty.'"

Appleton's Popular Science Monthly for April contains the Presidential address by Surgeon-General George M. Sternberg before the Biological Society of Washington on the 'Practical Results of Bacteriological Researches,' an article on the X-rays by Prof. Trowbridge, a continuation of the articles by Mr. Herbert Spencer, Prof. Ripley and Prof. Newbold, and other articles of interest, including a sketch of Benjamin Smith Barton, with a portrait.

UNIVERSITY AND EDUCATIONAL NEWS.

THE Calendar of the University of Michigan for 1896–97 shows the following attendance :

Department of Literature, Science and the Arts	1204
" of Engineering	331
" of Medicine and Surgery	452
" of Law	675
School of Pharmacy	83

Homœopathic Medical College	27
College of Dental Surgery	189
	2961
Deduct for students enrolled in more than one department	44
	2917
Students in Summer School, 1895	97
Total	3014

The number of instructors is 160. The average annual fees (including laboratory fees) are about $50.00 per student.

MR. JOSEPH FIELD has given Mount Holyoke College $6,000 to found a scholarship in memory of his mother. The Catholic University of Washington has received $5,000 by the will of Mr. Bryant Lawrence.

DR. H. F. REID, late professor in the Case School of Applied Sciences, at Cleveland, O., has been made associate professor of geological physics in Johns Hopkins University.

THE accounts of the Cambridge University chest, as distinguished from the general University fund for the year 1895, shows that the total receipts were £39,681, 18s. 11d., and the total expenditures, £40,067, 6s. 8d. This sum includes £670 for the Observatory, £1,024, 7s. 7d. for the Botanic Garden, £4,550 for museums and lecture-room maintenance and £4,000 for the library.

THE French Chamber of Deputies has passed unanimously a bill giving the various French faculties the titles and privileges of universities. This would establish universities at the following places: Paris, Dijon, Lyons, Bordeaux, Montpellier, Lille, Toulouse, Nancy, Rennes, Aix, Poitiers, Caen and Grenoble. It is stated that there are now 24,000 students attending these faculties and that they receive annual subsidies from the government amounting to about $2,800,000.

THE Electro-technical Institute of Darmstadt has received about $100,000 from the government for the purchase of new ground and for the enlargement of the buildings.

WE learn from the *Naturwissenschaftliche Rundschau* that Dr. Julius Bauschinger, of the observatory at Munich, has been appointed as full professor of astronomy in the University of Berlin. Dr. H. W. Bakhuis Rosebom has been made professor of chemistry at the University of Amsterdam, and Dr. A. Bistrzycki has been called to the professorship of analytical and technical chemistry in the University of Freiburg, in Switzerland.

DISCUSSION AND CORRESPONDENCE.

CERTITUDES AND ILLUSIONS.

EDITOR OF SCIENCE: Your correspondent in the last number of SCIENCE (pages 513–514), in making comments about my last article on 'Certitudes and Illusions' (pages 426–433), asks four pertinent questions, all of which were definitely answered in the article, but which are worthy of restatement in other terms. These questions are as follows:

First.—What is motion?

Motion is change of position. In the change of position two elements are involved, the speed of the change of position and the path of the change of position. We may reason about the speed or we may reason about the path, but these two elements must not be confounded, lest they lead to illusion. This is a concrete world, and there is no speed without path and no path without speed; we may reason abstractly, but the abstraction must be complete.

Second.—What is rest?

Rest is a mode of motion. I have defined the use of the terms particle and body, and the definitions need not here be repeated. In nature the ultimate particle is combined in a hierarchy of bodies, the atom is probably combined of particles, the molecule is known to be combined of particles, the molecules are combined into molar bodies, the molar bodies are combined in the earth, the earth is combined in the solar system. The particle has the motion of all of these bodies. If any body has a motion differentiated from the motion of any other body in the same rank of the hierarchy in such manner that the body as a unit has a motion distinct from the bodily motion of the next higher unit, that motion may be accelerated positively or negatively, but this can be done only by deflecting its motions in all other bodies of the hierarchy. Let us take the case of molar motion. The molar body partakes of the motion of the earth and the solar system,

and also partakes of the motion of its molecules, atoms and particles; a motion of the molar body, as a differentiated motion of that molar body, is a deflection of the motions in all the other bodies of the hierarchy, but if these other motions be not deflected, as a motion of the molar body differentiated from the other molar bodies, it is at rest. In this case, therefore, rest is the absence of motion in a molar body which differentiates it from other molar bodies in respect to motion. Rest, then, in molar motion is stellar motion and molecular motion. Rest is the motion of a body in its superior and inferior incorporation, undifferentiated from the motions of the bodies of its own rank in the hierarchy of incorporations.

Third.—If by 'motion as speed' is meant 'velocity,' and if by its 'persistence' is meant invariability of velocity, what possesses this invariability? bodies, molecules, particles, atoms? and in reference to what is the velocity constant?

So far as can be determined from research, speed is constant in the ultimate particle, but the speed of the atom, if it is a compound body, is not constant. The speed of a molecule is not constant, and in general the speed of a body is not constant. The speed of a particle is constant in reference to itself at different times.

Fourth.—As a molecule is considered as a 'body' when reference is had to the atoms which compose it, can it have an 'invariable velocity' as a molecule and variable velocity as a 'body?'

The molecule has an invariable speed (or sum of speeds) in its ultimate particles, but as a molecule, or one composed of many, this one may have a variable speed. It will be recognized that I use the term speed rather than velocity, for the term velocity as it is used in physics does not mean speed. First, velocity is positive and negative; second, velocity is speed and trajectory. I have been trying to dispel the illusion which inheres in the double use of velocity when we fail to distinguish between speed and path. The abstraction must be perfect when we reason abstractly; when we reason concretely then abstractions must be combined. Two molar bodies in motion as such may collide with each other, both may be deflected, both may come to rest, or one may be deflected and the other come to rest. All of these cases are concretely explained as velocity in physics. Velocity is a concrete term, not an abstract term. The velocity of a body as speed and path is constant. When a particle or body moves in a straight line its speed and its velocity are the same, but when a particle or body moves in a deflected line the velocity is measured by its speed and the force by which it is deflected. The distinction between speed and deflection is well marked by some English physicists who speak of *spirt* and *shunt*. When we consider the rate of motion we consider speed, not velocity, and we may consider speed in every incorporation in which an ultimate particle is found, and its total speed is the sum of all its speeds.

Let me ask your correspondent to once more consider my definitions and demonstrations, freeing himself from the illusion that velocity is the same as speed, making a perfect abstraction of those things which we are considering abstractly and a perfect comprehension of those things which we are considering concretely.

Finally your correspondent says:

I cannot refrain from expressing a hope, however, that in addition to these answers, Major Powell will kindly furnish an explanation of what he means when he says that the transmission of light at the rate of 299,878,000 metres per second, furnishes an example of 'particle motion at a velocity so great that any observed molecular motion sinks into insignificance.'

This assures me that your correspondent was attentive to my language, and I wonder whether he detected some other misprints in my article. In the same paragraph I say: "The molecular motion of a cannon ball at its mouth is from 518 to 671 metres per second." Of course I should have said the *molar* motion of a cannon ball. If in these cases he will substitute molar for molecular he will understand what I intended. On reading the published article I discovered this and one or two other errors, which are probably due to my habit of dictation, but thought them hardly worth noticing, as I belived that every intelligent reader would discover the errors and correct them himself.

J. W. POWELL.

VIVISECTION.

EDITOR OF SCIENCE: I note with regret several errors in the report (SCIENCE, April 3d) of my paper on 'Vivisection; Its Objects and Results,' read before the Anthropological Society of Washington at its meeting on March 3d.

I shall only correct the one which first meets the eye and which makes me appear to have made a very ridiculous statement. The report commences as follows: "In the course of his paper Dr. Sternberg said that by dissection of dead plants and animals only can we determine the nature of their functions." The following quotation from my manuscript shows what I really said:

"By means of the experimental method the chemist has succeeded in analyzing air, earth and water, which were regarded by the ancients as elements, and has learned to manufacture in his laboratory, by synthetic processes, many of the complex organic substances found in nature. By experiment the physicist has demonstrated the persistence of force and the corelation of the various modes of motion known to us as heat, electricity, etc. He has learned to recognize the elements of the chemist in distant suns by means of the spectroscope and has recently shown us that certain ethereal vibrations may pass through wood and metal as light rays pass through glass.

"In like manner biologists and physicians have established the facts which constitute our knowledge of biology in all its branches. Used in its broadest sense, this term includes animal and vegetable physiology, animal and vegetable pathology, ætiology, morphology, embryology, psychology and sociology. Now, it is evident that all questions relating to these various branches of biological knowledge must be determined by the observation of *living* organisms and by experiments upon *living* plants and animals. To some extent the study of morphology and of pathology constitutes an exception to this general rule, inasmuch as these branches of biological science also call for the dissection of dead plants and animals. Our knowledge of animal and vegetable histology, of human anatomy and of the results of disease processes has been obtained in this way, and could not have been obtained in any other way. But *the dissection of dead plants and animals cannot determine the functions* of the various anatomical elements and organs revealed by such dissections, although aided by the microtome, differential staining methods, the microscope, etc."

GEO. M. STERNBERG.

WASHINGTON, D. C.

INSTINCT.

EDITOR OF SCIENCE: Prof. Lucas seems to me to have advanced this discussion on instinct by his reference to a letter in *Nature*, which appeared in Vol. 52, page 30. According to the writer, it is customary for the Asamese natives to 'teach' the young jungle fowls to peck.

If this be true, what then becomes of Prof. Morgan's distinction?

As a matter of fact, if one observes a good many chicks, he will find that a large proportion of the birds never peck without suggestion (the term 'teach' seems objectionable) from the hen or some substitute. The chief value of such facts grows out of their showing that instincts are never perfect and never of that type once believed in—the unalterable, inevitable and unvarying—like the rising and setting of the sun; and for such rigid notions the reports of some scientists are in part responsible. It sometimes happened that experimenters in biology, etc., omit the exceptions and report only 'good experiments,' so that a false view of the case must necessarily arise. Prof. Baldwin seems to adopt Prof. Morgan's views, for he refers to the observation that the chicks drank 'only after they had the taste of water by accident or by imitating the old fowl.' Granted—but they also peck only after *seeing* small objects under certain conditions, and there is no instinct that does not require some stimulus in the environment to bring it into action. The mechanism is ready, but it is useless without this stimulus.

If one knew but of those domestic chicks or those jungle chicks that peck only on seeing this act, one might speak of a certain imperfection in the instinct of pecking, as, if you will, in

drinking; but what I must again object to is drawing radically different conclusions as to the nature of eating and drinking by chicks, and even building theories of evolution on them.

As I understand Prof. Cope is to reply to Prof. Baldwin's views on Consciousness and Evolution through the medium of the *American Naturalist*, I will only remark regarding his discussion in SCIENCE, p. 438, on Heredity and Instinct, that, while I find his views very interesting as illustrations of natural selection, the Lamarckian principle, the influence of environment, etc., they seem, in the main, to fall within the range of principles already recognized by the Darwinians and Lamarckians, though perhaps not adequately. But I fail to see that a single safe step can be taken in explaining evolution either in biology or psychology, if the effects of the environment and of use be ignored; indeed, Prof. Baldwin's very facts and illustrations are, to my mind, only comprehensible by the introduction of those factors; and why there should be such anxiety on the part of many to get rid of factors so obvious, and to substitute for them the biological fatalism and reasoning in a circle of Weismann, is a puzzle to me.

I trust Prof. Baldwin will not insist on coining many new terms, or favor their adoption as far as evolution is concerned. 'Social heredity' is about equivalent, is it not, to social environment, and the entire environment is one into which, as a rule, the animal is born, so why speak of 'social heredity?' Technicalities have their advantages, but they often conduce to mental myopia, and hamper the comprehension and progress of truth by binding it up in packages, so to speak—packages which all cannot readily undo. WESLEY MILLS.

McGILL UNIVERSITY.

FOOTGEAR.

EDITOR OF SCIENCE: Apropos of the heel quarters or heel bands on the feet of men shown on Mexican and Maya sculpture and pottery Dr. Fewkes calls my attention to the fact that among the Tusayan Indians an embroidered heel band is worn over the moccasins in all dances. In the statuary shown by Maudslay and other authors the footgear looks as though a man were wearing a gaiter from which the vamp or front had been cut away. In this view the supposed sole is the pedestal; what appears to be a stocking is the moccasin, and the heel quarter is the decorated ceremonial heel band fastened across the instep with lacings. O. T. MASON.

WASHINGTON, D. C.

SCIENTIFIC LITERATURE.

Greenland Icefields and Life in the North Atlantic, with a New Discussion of the Causes of the Ice Age. By G. FREDERICK WRIGHT, D. D., LL. D., F. G. S. A., author of the *Ice Age in North America*, etc., and WARREN UPHAM, A. M., F. G. S. A., late of the Geological Surveys of New Hampshire, Minnesota and the United States. With numerous maps and illustrations. New York, D. Appleton & Co. 1896. 12mo. pp. xv+407.

The immediate impulse to the preparation of this volume arose in connection with a trip to Greenland taken on the unfortunate steamer Miranda in 1894. It will be remembered that this steamship of eleven hundred tons' burden started out with the intention of reaching Peary's headquarters in Inglefield gulf, with a complement of fifty-one passengers. Ten days out she collided with an iceberg off Labrador and returned to St. Johns for repairs. After reaching Sukkertoppen, the largest Eskimo settlement in Greenland, the steamer ran upon a reef and received serious injuries, compelling her to stop again for repairs and to start homeward as soon as possible. In less than two days' time she foundered, and the passengers and crew were safely transferred to the schooner Rigel. The senior author had an excellent opportunity to study icebergs in their legitimate work of producing geological changes, and had nearly a fortnight's time to explore the edge of the ice sheet close to the Arctic circle.

The authors have improved their opportunities by giving in this book an interesting resumé of what is known respecting the glaciers, ice fields, explorations, icebergs in action, the plants, animals, the Eskimo and the early Norsemen of Greenland. Mr. Upham prepared the chapters upon the plants, animals, explorations, and the lessons taught by the Greenland phenomena in the elucidation of the Ice Age. Besides the text several excellent maps of

Greenland, Labrador and the whole northern regions were drawn by him; and he has restated his views respecting the causes of the cold.

Greenland has an area of 680,000 square miles, of which 575,000 are occupied by the ice sheet. On the east side the coast consists very largely of ice cliffs, while on the west there is a border of habitable land towards twenty miles in width for more than half its length, and numerous glaciers cross this belt, reaching the sea and discharging icebergs therein. The edge of the ice is usually from 1,500 to 2,000 feet above the sea, quite precipitous; and thence the ice surface gradually rises to the altitude of 8,000 to 9,000 feet on the watershed, the whole surface being inclined westerly, at first six and later two degrees, till the summit is reached and the slope becomes easterly. Hayes called the interior 'a vast frozen Sahara immeasurable to the human eye.' Near the boundary, because of the greater ablation, the surface is crevassed and rivers flow freely, occasionally plunging into the abysses. The great central region is the analogue of the *névé* fields or gathering ground of the ice.

Areas of considerable altitude uncovered by ice or snow and hence bare rock or earth capable of sustaining vegetation like the Alpine garden of the *Mer de Glace*, in Switzerland, are called *nunatakr* (singular *nunatak*) by the natives. This word supplies a needed place in our vocabulary, and is being extensively used by glacialists.

The most important inland expeditions were those of Dr. Hayes, in Lat. 78°, 1860; Nordenskiold, in 1881, Lat. 68°; Nansen, 1888, in Lat. 64°, and of Peary, 1892, Lat. 78° to 82°. The last two only went entirely across the island. Nansen found that the kryokonite, described by Nordenskiold, as cosmic dust was rather to be regarded as material blown by the winds from the coast. Peary's trip was of the most consequence, as it was the farthest north and practically two routes, as the return road lay a hundred miles nearer the pole.

The notices of processions of icebergs and flows help to the understanding of the effects produced by floating ice, which are liable to be depreciated in these days when the glacier is invoked as the great agent at work. The bergs off the Labrador coast constitute a stream one hundred miles wide and one thousand miles long, derived chiefly from the north part of Greenland. Numerous seals accompany them, finding the conditions favorable for procuring food and for rearing their young. Their number is given as hundreds of thousands. In their train follow the Arctic bear, fox and innumerable flocks of birds, all dependent ultimately upon the food which the seals secure from the sea. Their worst enemy is man, and as the number of hunters has increased, with weapons terribly destructive, the products are diminishing in amount, so that the late financial collapse of Newfoundland is partially due to the poor success of the sealers.

A more important stream of floating ice is that which starts in the frozen seas north of Siberia, passes by the pole, skirts the east coast of Greenland and partially turns to the northwest at Cape Farewell. This procession commences late in January, as seen in southern Greenland, and continues into September. Intermingled with the ice are pieces of floodwood, which furnish the Greenlanders with lumber and firewood. Sometimes logs sixty feet in length are drifted upon the shore. Rink conjectures that the annual gleanings upon the whole coast may amount to from eighty to one hundred and twenty cords, a small part of which passes 68° N. Lat. This wood seems to have grown upon the banks of rivers in Siberia, being coniferous, and thus is unlike that drifted to the shores of northern Europe by the Gulf Stream. Freshets carry the logs far out into the Arctic sea, where they are drawn into a slow but steady current, which first sets to the northward from the northern coast of Asia and from Spitzbergen, and then passing on southwards conducts the ice floes of that region along the eastern coast of Greenland. It is to this current that Nansen has committed himself, confidently expecting to be carried past the north pole. Mr. Upham's map shows very clearly this projected route from Bennett's island or from the gulf of the Ob across to Greenland.

The story is well told of the Tertiary warm temperate plants of Greenland, so allied to the similar remains found upon both continents as to necessitate the belief of an early land connection between Europe and America. The

present flora, enumerated at 386 species by Lange, contains a slightly larger number of European than American species. Warming finds two botanical regions, of which the southern is characterized by the presence of the white birch, extending two degrees north from Cape Farewell, and contains many European types. The larger, or northern, region is more American in its facies, but the majority of the plants are circumpolar. Most authors have regarded this flora as of Scandinavian origin; but the suggestion is here made of the possibility of its being merely the wreck of the earlier Tertiary development. The Greenland flora is essentially that of the highest White Mountain summits.

All these and other details concerning the physical features of Greenland help us to imagine the condition of things over our northern regions in the ice age. Greenland must have had a greater development of ice in former times, since the present habitable strip of land is glaciated; but the authors believe it was milder there in the times of the early Norse settlements several hundred years ago. The débris in Greenland is principally transported in the lower part of the glaciers, whence it is possible to believe in a similar movement for the material of the drumlins and many boulders. The Greenland ice moves more rapidly than the Alaskan and Alpine glaciers, averaging about fifty feet daily. This may be due partly to the steeper slopes, which are from 100 to 200 feet per mile. Inclinations of fifty feet to the mile are necessary for vigorous movement; but a large part of the American ice did not possess surface slopes of more than twenty-five or thirty feet to the mile.

Attention is paid to the great elevatory movements of our continent upon both the Atlantic and Pacific coast, as well as on the Gulf of Mexice, which took place in pre-glacial times—from 2,000 to 3,000 feet in amount—and it is thought this uplift has been sufficient to develop the severe glacial climate. The astronomical theories, including the latest views of Croll, Wallace, Drayson, Becker, Sir Robert Ball and Sir John Evans, are weighed in the balance and found wanting in the comparison. The great uplift would have given rise to a high plateau climate with abundant snowfall and accumulation of an ice sheet, whose weight seems to have been a chief cause of the ensuing depression in the Champlain age.

The distribution of the till, more or less coincident with terminal moraines, allows of a classification into stages.

First came the culmination of the Lafayette uplift, which is regarded as Quaternary and therefore not to be esteemed as the equivalent of the Scanian or Norfolkian of Geikie, as they belong to the Pliocene. It includes the Albertan and Saskatchewan stages of G. M. Dawson. Next came the Kansan, Aftonian and Iowan stages, all of the four named being classified as the *Glacial* epoch proper. The second epoch is named the *Champlain*, being the time of melting and of subsidence, and is divided into the Champlain marine beds, the Wisconsin drift sheet indicating moderate reëlevation, the Warren glacial lake, the Toronto stage of temperate climate, the Iroquois lake and the St. Lawrence lake, overflowing through the Champlain basin into the Hudson river. The number of stages agrees exactly with those specified by Geikie for Europe, provided the Lafayette consist of two. The authors rank themselves as advocates of the unity of the glacial epoch. It is probable that the present diverse schools of glacialists will tend hereafter to a greater convergence than divergence. C. H. HITCHCOCK.

Hansen's Studies in Fermentation. Practical Studies in Fermentation, being contributions to the Life History of Micro-organisms. By EMIL CHRISTIAN HANSEN, PH. D., Professor and Director of the Carlsberg Physiological Laboratory, Copenhagen. Translated by ALEX. K. MILLER, PH. D., F. I. C., F. C. S., and Revised by the Author. E. & F. N. Spon, London and New York (12 Courtland St.), 1896. Pp. xiv+277. 8vo. Illustrations. Cloth.

The general features of Dr. Hansen's reform in the fermentative industries have long been known to every one who is interested in the scientific and practical features of applied mycology. They are known as new and important departures in regard to method and application, and as important factors in the evolution of

great industries. Having been successfully outlined in Jörgensen's admirable text-book, 'Micro-organisms and Fermentation' (London, 1893), they are now presented to the public as exhaustively as necessary to the practitioner as well as to those who, without being zymotechnics *ex-professo*, need to become acquainted with the original work of Hansen.

The present volume 'treats,' as the author expresses himself, 'in the main, of the great questions of the circulation in nature of the alcoholic fungi, their relationship to the diseases of beer, the pure cultivation of yeast, and the employment of systematically selected species and races.'

Until the beginning of the last decennium the fermentation of beer, wine, etc., the souring of milk, and other procedures involving an employment of the vitality of micro-organisms, were carried out more or less at random. Pasteur taught us that if the fermentation in beerwort shall terminate in the formation of a fair product, no bacteria must be present in the yeast. Thus, Pasteur's 'pure yeast' refers to yeast free from bacteria. Hansen went further than this. Having discovered the scientific reasons why yeast is not constant with reference to its morphological and physiological peculiarities, he established the maxime, now generally accepted, that yeasts, as commonly used in breweries, are mixtures of cultivated and uncultivated species of *Saccharomyces*, and that most of the latter so-called 'wild' forms are 'disease'-producing, that is, give rise to fermentations unfavorable to both producers and consumers. They were found to cause—aside from certain bacteria which are known to impair the results of fermentations in the brewery—many of the symptoms which are familiar to brewers, such as bitter taste and disagreeable odor, lack of constancy in the product, and the like.

Hansen's studies resulted directly in a method by which it is in the power of any brewery to secure a uniform, good product. Systematically selected culture yeasts would, when introduced into the brewing establishments, be certain to yield uniform, good grades of beer.

The proper selection of races was facilitated by a new method of pure cultivation, allowing the observer to trace the development of cultures from individual well-defined cells.*

The successful introduction of *Hansen's* system into nearly all countries speaks eloquently for its merits.

The major part of the volume refers to the practical side of the question, but, as it is based upon new methods in the study of microscopic fungi, considerable space is devoted also to the botanical study of these, especially of the yeasts. Hence the appropriate sub-title noted above.

The indirect result of Hansen's work is a new departure in the dairy industry. Storch, of Copenhagen, applied the principle of selected species of organisms to the ripening of cream, and was followed by a number of able investigators, among whom is Professor Conn, of this country, who demonstrated the necessity of selecting such forms of the lactic acid bacteria as were found to produce an ideal ripening for rational dairying. In this manner improved grades of butter may be produced and maintained.

The publications of Wortmann and others show that the question of pure cultivation of wine yeasts is rapidly gaining in favor and influence with the German and French manufacturers of wines.

In distilleries the system has also been successfully adopted.

Hansen's late studies of the acetic *bacteria*† seem to indicate a rapidly advancing reform in the manufacture of vinegar, based upon the same principle as has been followed year after year by agriculturists throughout the world, namely, that pure seed secure a pure crop.

Space does not permit a recapitulation of the substantial volume before us. Yet it is evident that every one whose work in any respect touches upon fermentations will find it among those publications which must inevitably be consulted in all future work.

*This method was described exhaustively by the reviewer in the *American Monthly Microscopical Journal*, XV., 35—40, 1894; with plate.

†Comp. rend. d. trav. du laboratoire de Carlsberg III., 265-327, 1894. Ber. d. Deutschen Bot. Ges. XI., (69)-(73), 1893. See also Lafar; Centralbl. f. Bakt. u. Par XIII., 684-697, 1894; idem, zweite Abtheilung, I., 129-150; 1895.

The appearance of the book is in every way faultless.

J. CHRISTIAN BAY.
IOWA STATE BOARD OF HEALTH,

SCIENTIFIC JOURNALS.

THE AMERICAN GEOLOGIST, APRIL.

Apparent Anomalies of Stratification in the Postville Well: By SAMUEL CALVIN. A recently bored well in northeastern Iowa shows a remarkable and unusual thickness of shaly material in the St. Peter Sandstone. Caverns are frequent in this unconsolidated and easily eroded sandstone, and the author suggests that in this case a cavern was formed in the St. Peter sandstone and it was afterward filled by descending waters with material from the shaly members of the overlying Trenton.

Englacial Drift: By W. O. CROSBY. In the longest paper of this number, Prof. Crosby presents a very thorough discussion of the drift which was transported in the lower part of the thick Pleistocene ice sheets, comparing them with the Malaspina Glacier and with the present ice sheet of the interior of Greenland. To designate the drift so enclosed in glaciers and ice sheets, Chamberlin proposed the term englacial, but he supposes that this part was of small amount in comparison with the drift dragged and pushed along beneath the ice as its ground moraine. Crosby shows by the almost universally glaciated surface of the bedrocks beneath the drift, excepting near the borders of the drift-bearing areas, that the ice sheet gathered into its lower part all the preglacial residuary soil and alluvium, until the base of the ice, thickly charged with englacial drift, wore into the hard underlying rocks. With the return of a warm climate, during the Champlain epoch, causing the final recession and departure of the ice, Prof. Crosby thinks that the rapid surface melting was accompanied also by much melting of the base of the ice sheet, whereby much of the previously englacial drift was deposited as subglacial till. It becomes, therefore, difficult to discriminate the finally subglacial deposits from the portion of the drift which continued to be englacial until the surface melting or ablation at last exposed it as superglacial till. The origin of the modified drift, or stratified gravel, sand and clay, brought by streams of water from the drift-laden ice, Prof. Crosby ascribes in its larger part to subglacial drainage, rather than to the superglacial streams which Upham has regarded as the chief agency of derivation of these beds during the mainly rapid final retreat of the ice.

Further examination of the Fisher Meteorite: By N. H. WINCHELL. Further careful study of this interesting meteorite shows that it contains considerable glass, the mineral asmanite (tridymite), and very probably the mineral maskelynite.

Preliminary Notes on Studies of the Great Lakes made in 1895: By F. B. TAYLOR. The author states that his explorations and studies during 1895 lead him to doubt his former reference of the high shore lines about the upper great lakes of the St. Lawrence to marine submergence attending or following the close of the Ice Age, instead of which he now concludes that probably all these shores belonged to vast lakes held by the barrier of the waning ice sheet. He asserts, however, that the glacial Lake Warren, according to his exploration of its shores, was limited to the basin of Lake Erie and the southern part of the Huron basin, outflowing by the Pewano channel, southwest of Saginaw Bay, to the glacial Lake Michigan. The very high shores around Lake Superior and the northern part of Lake Huron and Georgian Bay, he attributes to the later Lake Algonquin, with outlet by a river flowing to the south and east along the present bed of Lake Erie.

In an editorial comment by Mr. Warren Upham, referring to Mr. Taylor's paper, it is suggested that only the highest beach which had been attributed to Lake Warren in the Erie basin may represent the Pewamo outlet, and that later stages of Lake Warren, flowing past Chicago to the Des Plaines and Illinois rivers, probably formed the Arkona and Forest or upper or lower Crittenden beaches, and the high shores of the Georgian Bay region, and also of Lake Superior, excepting those of its western part belonging to an earlier glacial lake.

THE MONIST, APRIL, 1896.

PROF. MACH describes a method of using Röntgen's X-rays for obtaining stereoscopic

views of invisible objects. Two photographic shadow-pictures, say of a mouse, are obtained from two different points of view and stereoscopically combined into a solid phantom-picture, showing the skeleton, etc., in actual relief. This is simply a modification, by the use of the Röntgen rays, of Mach's old and well-known method of getting solid views of concealed anatomical structures, etc. Prof. Mach has also a few remarks to make on the physical character of the X-rays. The same subject is treated at length in a second article by Prof. Hermann Schubert, who gives an account of the methods successfully employed in the Hamburg State Laboratory. Two actinograms, one of a plaice with shells in its intestines, and one of a lady's hand, showing the position of a fragment of a needle, accompany this article.

In the third article Edward Atkinson discusses 'The Philosophy of Money.' A Polish philosopher, W. Lutoslawski, of Kazan, gives a brief sketch of the philosophy of Polish individualism.

The article 'From Animal to Man,' by Prof. Joseph Le Conte, is a contribution to comparative psychology. Considering successively speech, art, thought, imagination, consciousness and will, Prof. Le Conte tries to put his finger as nearly as he can 'on the dividing line where humanity emerges out of animality.' The abstraction of *self* from the facts of consciousness, he thinks, may be regarded as the consummation of humanity. 'The Dualistic Conception of Nature' is a contribution by Prof. J. Clark Murray, tracing the fortunes of dualistic notions in the history of philosophy and religion.

Prof. Kurd Lasswitz attacks a more difficult problem in 'Nature and the Individual Mind,' a metaphysical question of profound interest to psychologists and philosophers. Prof. Lasswitz seeks to show that there is no change of mode of existence when things physical become things mental; the difference is merely a difference of combination of elements. 'Objective and subjective are distinguished solely by their existential contents.' The opposition of object and subject is originally produced in and by knowledge, and nature itself is fashioned on lines parallel with the growth of knowledge. The doctrine of 'parallelism' which views physical and psychical phenomena as two modes of representation of the same synthesis is critically discussed, and we have also an interesting application of the psychological law of thresholds as marking the difference between nature and mind.

The last article is a discussion of the 'Nature of Pleasure and Pain,' by Dr. Paul Carus, with particular reference to the theory of Ribot. He thinks that the current views of pleasure and pain exhibit a neglect of the element of form or of the qualitative aspect of feeling. In his view the nature of a commotion is determined by its relation to the constitution and memory-structures of an organism. Pleasure is the satisfaction of a want originating in constitutional habits; pain is the felt evidence of an unsatisfied want or of any other disturbance. The author claims that this view will do away with all troublesome exceptions and inconsistencies of the old theories.

The number concludes with the usual literary correspondence and book reviews.

SOCIETIES AND ACADEMIES.

BIOLOGICAL SOCIETY OF WASHINGTON—258TH MEETING, SATURDAY, MARCH 21.

BARTON W. EVERMANN exhibited specimens of *Animals from an Artesian Well at San Marcos, Texas.* This well was sunk to obtain water for the station of the U. S. Fish Commission, and when the drill had reached a depth of 180 feet it dropped four feet, indicating the presence of a cavity. Although sunk much deeper, the well was finally closed up to a depth of 184 feet, an abundant supply of water being obtained at that level. The water flowing from the well contained a considerable number of crustaceans and a few batrachians, all blind and all new. The crustaceans comprised one species of shrimp, an isopod and a copepod. The batrachian, according to Dr. Stejneger, belonged to the Proteida, but was remarkable for the great length of its legs.

C. Hart Merriam spoke of the *Big Bears of North America*, giving the distinctive characters of the various species.

Leonhard Stejneger spoke on *The Use of*

Formalin in the Field, illustrating his remarks with examples of plants, insects, fishes and reptiles preserved in a mixture of formalin and water. The advantages claimed were cheapness, compactness, and the property of preserving specimens which could not be kept in alcohol, or could not be kept in such good condition.

Henry H. Dixon and J. Joly, of Trinity College, Dublin, summarized, by request, the results of their *Recent Researches on the Ascent of Sap in Trees*, making the deduction from an elaborate series of experiments that the movement was due to a state of tension in the sap induced by osmotic action and transpiration in the leaves. The chief necessary condition for maintaining a state of high tension (several atmospheres) is that the column of water shall not rupture, but to prevent rupture it is not necessary, as has been supposed, that the fluid shall contain no dissolved gas, but that the walls of the containing vessel be completely wet.

Under the title of *the Shade-tree Question from an Instinct Standpoint*, L. O. Howard presented a short communication upon the subject of the relative immunity from insects of different varieties of shade trees. He spoke of the extraordinary abundance of shade-tree insects in different Eastern cities during the summer of 1895, and exhibited specimens of the species which were principally abundant. He further said that in the selection of trees for shade sufficient account is not taken of their relative susceptibility to insect attack. He displayed a list drawn up a few years ago by Mr. Fernow for the Brooklyn authorities, in which the trees to be chosen were graded according to endurance, recuperative power, cleanliness, beauty and form, shade, duration of life period, rapidity of growth, and persistence; and in comparison with this list he rated the same trees according to their susceptibility to insect attack or their immunity from insect attack. The latter rating showed a somewhat different relative arrangement from the total rating derived from other qualities, and the speaker, while admitting the value of the total relative rating from so many important characteristics, expressed himself as of the opinion that in one or two cases, notably with the box elder, extraordinary susceptibility to insect attack renders them practically useless for shade-tree purposes, in spite of their many good qualities from other standpoints.

F. E. L. Beal read a paper on *the Food of the Cowbird, Molothrus ater*, giving the results of an examination of the contents of 366 stomachs of this species, collected in 20 States and the District of Columbia, and representing every month from March to December inclusive. The food was found to consist of about 28 per cent. of animal matter and 72 per cent. of vegetable. The animal food was composed almost exclusively of harmful insects and spiders. The vegetable food consists of 20 per cent. of grain (corn and oats), 51 per cent. of weed seeds and traces of fruit and a few other miscellaneous articles. As at least half of the grain eaten must have been waste, the conclusion is reached that in its food habits the cowbird does far more good than harm.

F. A. LUCAS,
Secretary.

CHEMICAL SOCIETY OF WASHINGTON.

THE eighty-sixth regular meeting was held February 13, 1896, at the rooms of the 'Downtown Club,' and after the transaction of necessary business, was devoted to a lunch and social purposes, inaugurating the newly elected president, Dr. E. A. de Schweinitz. The following members also were elected: Messrs. Clinton P. Townsend, S. S. Voorhees and Dr. F. K. Cameron.

A special meeting was held February 21st to hear the Presidential address of the retiring President, Prof. Chas. E. Munroe, the subject being 'The Development of Smokeless Powder.' He first sought to show that the necessity for a high power, smokeless propellant had been created by the mechanical perfection to which ordinance had attained, and the precision of the weapons and instruments by which they were directed; that the possible production of such propellants was dependent upon the discovery of gun cotton, nitro-glycerine and certain nitro-substitution compounds and the improvements in their manufacture; that the possibility of producing uniform and reliable propellants was dependent on the invention of pressure gauges and velocimeters; and that the possibility of

their economical production was dependent on the invention of mechanical mixers applied in other arts. In a historical resumé the recency of most of the inventions and discoveries was pointed out, and it was shown how large a proportion was due to American scientific men. The many smokeless powders manufactured or proposed were enumerated and classified into mixtures of different cellulose nitrates with oxidizing agents; mixtures of soluble or insoluble cellulose nitrates with nitro-glycerine; mixtures of cellulose nitrates with nitro-substitution compounds; and pure cellulose nitrate powders, and the methods of manufacture were briefly described.

The author's own experience in inventing a smokeless powder was then given. Recognizing at the outset the necessity for the closest approximation to absolute chemical and physical uniformity in a high-powered powder, and being familiar with the difficulty of securing such constancy in a physical mixture, he set about producing a powder from a carefully purified cellulose nitrate of the highest degree of nitration. This was the first and only attempt, so far as the lecturer was aware, to produce a powder which consisted of a single substance in its pure state.

The powder was manufactured at the Torpedo Station and proved at Indian Head by ordnance officers of the Navy. Secretary Tracy in his report (1892) says: "It became apparent to the Department, early in this administration, that unless it was content to fall behind the standard of military and naval progress abroad in respect to powder, it must take some steps to develop and to provide for the manufacture, in this country, of the new smokeless powder, from which extraordinary results had been obtained in Europe. With this object negotiations were at first attempted looking to the acquisition of the secret of its composition and manufacture. Finding itself unable to accomplish this, the Department turned its attention to the development of a similar product from independent investigation. The history of these investigations and of the successful work performed in this direction at the Torpedo Station has been recited in previous reports. It is a gratifying fact to be able to show that what we could not obtain through the assistance of others we succeeded in accomplishing ourselves, and that the results are considerably in advance of those hitherto obtained in foreign countries."

The conditions that smokeless powder should fulfill, and the tests prescribed by the lecturer were then set forth, and in closing he pointed out that the powder was now developed to a higher degree than the gun and that changes in the latter to render it more efficient were being considered by ordinance experts.

A. C. PEALE,
Secretary.

GEOLOGICAL SOCIETY OF WASHINGTON, MARCH 25, 1896.

MR. WHITMAN CROSS described the diorite of Ophir Loop, Colorado, and the remarkable inclusions contained in it. The diorite at this locality is a lateral arm of a stock which cuts up through Cretaceous sedimentary rocks and a bedded volcanic series of Tertiary andesites. The lateral offshoot from this stock is intruded as an irregular sheet between the Dakota Cretaceous and the upper Jurassic, reaching a thickness of 1,000 feet. In its lower portion it is locally very full of included rock fragments. These inclusions were described, and specimens were exhibited. They are interpreted as genetically connected with each other and with the diorite magma, which brought them to their present position.

The diorite is a variable rock, with augite and hornblende. The inclusions vary from feldspathic rocks, poor in dark silicates, to black amphibolites nearly free from feldspar. They are developed in granular and banded forms, and exhibit all manner of gradations in structure as well as in composition.

The study of these rocks led to the stated conclusions that quite local differentiation has gone on in the depths from which both diorite magma and inclusions came, and further, that a shearing movement of the differentiated magma, followed by consolidation, produced rocks greatly resembling many gneisses, amphibolites and schists, and especially those of the Archean complex. It was suggested that some gneisses and associated rocks of unexplained or assumed metamorphic origin may be primarily banded

igneous rocks, which should be considered with their massive equivalents rather than with secondary schists of similar constitution.

Mr. H. W. Turner described the *Archean Gneiss in the Sierra Nevada*. The western part of Nevada was thought by the geologists of the 40th Parallel Survey to be an Archean area which, during Paleozoic time was a land mass, since there are no known Paleozoic sediments resting on it. It was supposed that Archean rocks existed in the Sierra Nevada, although the Jurassic age of the hornblendic granites of that range, as stated by Whitney, was accepted by the 40th Parallel Survey geologists.

An area of such rocks is believed to exist in the central part of the range, and is well exposed in the canyon of the north fork of the Mokelumne River and its branches. The rocks are chiefly gneisses with which are associated a granite which differs from the Jurassic granite of the range in containing much potash feldspar, and no hornblende, or very little. This granite is indistinguishable from some of the Archean granite of the Fortieth Parallel survey collections. The gneisses vary much in composition, some of them being made up chiefly of plagioclase, monoclinic pyroxene and biotite; another type is composed of plagioclase, hornblende and biotite; others carry quartz, and correspond nearly to a quartz-mica-diorite in composition. Titanite, zircon, apatite and pyrrhotite are among the accessory minerals. Some of the titanites exhibit a pleoöchrism, like that found by Lacroix to be characteristic of that mineral in pyroxene-gneisses. Certain light colored bands containing garnet, quartz and a mineral resembling wollastonite, may represent original limestone lenses, or may be regarded as vein deposits. One stratum, supposed to be a quartzite in the field, contains much pyroxene between interlocking quartz grains, and also numerous zircons. By far the greater part of the area is made up of the plagioclase-hornblende-biotite gneiss. The contact of the series with the large mass of hornblendic granite lying to the east is sharp. Apophyses of the hornblendic (Jurassic?) granite extend into the gneiss and older granite as dikes, and there are clear cut inclusions of the gneiss in the late granite. All of the rocks composing this Archean complex are thoroughly crystalline, and there is at present no positive evidence that any portion of the mass represents original sediments. The area has a maximum diameter of about nine miles. On the west it is in contact with the great area of Paleozoic sediments of the Gold Belt of the Sierra Nevada. Its relation to this Paleozoic series has not been made out.

NATIONAL GEOGRAPHIC SOCIETY.

At the regular technical meeting of this Society held in Washington, D. C., March 20, Mr. Gilbert Thompson explained and advocated the use of geodetic control lines in geographic work as supplementary to primary triangulation, when such lines are measured with care and latitude and longitude determinations made, etc. Following him, Mr. N. H. Darton read a paper on the 'Physiographic Development of the District of Columbia Region.' He outlined the geologic history of the river from early Cretaceous time, mainly in its bearing on the cycles of development. The present configuration is the product of sculpturing and deposition in Pleistocene times, but buried beneath the various deposits there is a succession of older land surfaces. The earliest recognizable surface is the floor of crystalline rock on which the Potomac formation was deposited. This is exposed in many points in the vicinity of Washington and it is seen to be a relatively smooth peneplain surface, which originally sloped very gently to the east and southeast. Other similar plane surfaces were eroded in the uplifts separating the several later Cretaceous, Eocene, and Neocene formations. These were widely extended base levelings, which were part of the general Tertiary planing of the Piedmont region. The present topography began with the uplift of the Lafayette, which amounted to about 120 feet. As the land rose the Potomac river was born, with its seaward course deflected by shoals on the Lafayette surface. The minor drainage was developed with approximately its present outlines, cut more or less deeply. Then with slight submergence with deposition, in which the early Columbia formation was spread over the floor of the wide river trough, and up the lateral valleys.

Then followed emergence, in which the early Columbia deposits were trenched and a wide terraced inner valley cut by the river. The widening did not progress as far as in the pre-Columbia period and wide areas of earlier Columbia terrace remained, at altitudes averaging 200 feet. Next came submergence, in which the later Columbia was laid down, and then followed a widespread moderate uplift in which this formation was trenched to a few yards before the present tide level. The next epoch is the present, in which the land is sinking; tide water extends far inland and it is encroaching gradually. The paper was illustrated by many slides from photographs of maps, diagrams, topographical feature and formation.

W. F. MORSELL.

U. S. GEOLOGICAL SURVEY, WASHINGTON, D. C.

THE ACADEMY OF SCIENCE OF ST. LOUIS.

AT the meeting of the Academy of Science of St. Louis, April 6th, forty persons present, Prof. C. R. Sanger spoke on the commercial synthesis of acetylene, illustrating the flame procurable from this gas when burned with a proper proportion of air.

Prof. Sanger also presented the results of a preliminary biological and chemical examination into the ice supply of St. Louis, and exhibited a device for melting ice in such examinations without danger of contamination from atmospheric ammonia, etc.

The Secretary presented for publication, by title, a paper by Mr. Charles Robertson, entitled 'Flowers and Insects.'

Mr. William H. Roever presented a paper on the geometry of the lines of force from an electrified body, in which it was shown that (a) the curve representing a line of force proceeding from a system consisting of two parallel electrified lines, is the locus of the intersection of two straight lines, rotating in the same plane about these two parallel lines as axes with uniform but different angular velocities; (b) the curve representing a line of force proceeding from a system consisting of two electrified points is the locus of the intersection of two straight lines, rotating, in the same plane about parallel axes passing through those points in such a manner that the versines of their angles of inclination to the plane of the axes change at uniform but different rates.

WILLIAM TRELEASE,
Recording Secretary.

BOSTON SOCIETY OF NATURAL HISTORY.

BY the courtesy of the Massachusetts Institute of Technology the Society held its general meeting of March 18th in the physical lecture room of the Institute. Four hundred persons present. Prof. Charles R. Cross spoke of the X-rays, discussing the subject from an historical standpoint. He illustrated the phenomena connected with the disruptive discharges of electricity across an air space, across a space wherein there is little air, and in a tube in which a nearly perfect vacuum is maintained. The experiments and theories of Crookes, Herz and Lenard were reviewed; the distinctive characters of the X-rays, and the experiments of Röntgen described. The fluorescence of certain substances, such as platino-cyanide of barium, a marked peculiarity of the X-rays, was shown by illuminating a Crookes tube placed in a light-tight box; the rays passing through sheets of vulcanite and aluminum caused a prepared slip of platino-cyanide of barium to glow with a soft phosphorescent light. The work of various experimenters upon photographic plates and upon electrified substances was described in detail. Experiments to show the effect of the X-rays upon Bacteria, while not final, point to the conclusion that the Bacteria are not killed.

SAMUEL HENSHAW,
Secretary.

ACADEMY OF NATURAL SCIENCES OF PHILADELPHIA.

March 31.—A paper under the following title was presented for publication: 'Dr. Collet on the morphology of the cranium and the auricular openings in the North European species of the family Strigidæ; to which is added some recent opinions upon the systematic position of the Owls,' by R. W. Shufeldt.

Prof. Henry A. Pilsbry called attention to a fine collection of barnacles obtained from the bottom of a vessel recently returned from a

voyage to Hong Kong from San Francisco and back by way of Java and India. *Balanus tintinabulum* was the commonest of the species represented; the varieties *zebra* and *spinosus*, although growing under identical conditions, retained their individuality perfectly.

The question of the constancy of varietal characters was debated by Messrs. Sharp, Pilsbry and Heilprin.

Mr. Pilsbry also described a specimen of *Pugnus parvus*, a Ringiculate mollusk. The species is involute, a unique character, none of the fossil forms of the family possessing it. He also described a Central American Melanian under the name *Pachycheilus Dalli*. It is distinguished by a remarkable double sinuation of the outer lip which has a deep and wide Pleurotonoid sinus above and a rounded, projecting lobe in the middle, below which it is again retracted.

On the nomination of the Entomological Section, Dr. Henry Skinner was elected Professor in the Department of Insecta.

In response to an invitation from the Committee having charge of the celebration of the fiftieth year of Lord Kelvin's tenure of office as Professor of Natural Philosophy in the University of Glasgow, General Isaac Jones Wistar was appointed to represent the Academy on the occasion.

Entomological Section, Dr. Henry Skinner, Recorder, March 25.—Dr. Geo. H. Horn made a communication regarding the synomymy of the Elateridæ. He specially described the prosternum of *Ludius*. A Lower California form had the prosternum of different shape from that of other members of the genus, the mesosternum being more protuberant. It will probably be referred to *Probothrium*.

Mr. Chas. S. Welles exhibited specimens of the larva of *Harrisimemna trisignata*. When full grown they bore into wood preparatory to changing into crysalids.

A paper was read entitled 'The breeding habits of *Periplaneta orientalis*,' by C. Few Seiss. Three females deposited twenty-five egg cases. Each of these contained sixteen eggs, so that a new generation of four hundred cockroaches was represented by the deposit. The first of these egg cases were dropped May 5 and 14, 1895, and were hatched November 9th. In most cases the deposits were dropped with no attempt at concealment, although in a few instances they were placed in little trenches made by the insect and then covered up. The development of the capsules was described. The young probably receive no maternal care or protection.

Mr. Lancaster Thomas exhibited an improved form of insect net frame made of a continuous piece of rounded aluminum wire.

Mr. Westcott suggested linoleum as a substitute for cork in the arrangement of insects. Dr. Henry Skinner called attention to a fungus, *Polyporus betulinus*, which might be used for the same purpose with advantage.

Mr. Wm. J. Fox stated that about ninety species of Hymenoptera, six of which were perhaps new to science, were included in the collection of insects brought by Dr. A. Donaldson Smith from western Somali Land, Africa.

EDWARD J. NOLAN,
Recording Secretary.

NEW BOOKS.

Text-book of Comparative Anatomy, Part II. ARNOLD LANG; translated by Henry M. Bernard and Matilda Bernard. London and New York, Macmillan & Co. 1896. Pp. xvi+618. $5.50.

Memoirs of Frederick A. P. Barnard. JOHN FULTON. New York and London, Columbia University Press, Macmillian & Co. 1896. Pp. xii+485. $4.00.

Water Supply. WILLIAM P. MASON. New York, John Wiley & Sons. London, Chapman & Hall, Ltd. 1896. Pp. iv+504.

A Dictionary of the Names of Minerals. ALBERT HUNTINGTON CHESTER. New York, John Wiley & Sons. London, Chapman & Hall, Ltd. 1896. Pp. xv+320.

Geschichte der Explosivstoffe. S. J. ROMOCKI. Volumes 1 and 2. Berlin, Robert Oppenheimer. 1895, 1896. Pp. vi+394, xiv+324. M 12.

Twenty-first Annual Report of the Secretary of the State Board of Health of Michigan. Lansing, Robert Smith & Co. 1895. Pp. cxxiv +444.